



Restoration Project Scoping Report for the Cornell Dubilier Electronics, Inc. Superfund Site Natural Resources Trustee Council

Prepared for

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The information gathered from survey respondents represents the best professional judgement of the survey respondents towards their submitted projects and does not necessarily reflect the viewpoint of the Trustees. Reporting discrepancies are to be expected in the early conceptual formation phase of projects. Project reporting of acres, stream miles, costs and benefits for example may differ from what may later be deemed as actual figures. The Trustees have made an effort to clarify and correct the information with the help of the survey respondents whenever possible. The Trustees, having knowledge of the watershed and of specific project locations, provided information on potential risks and uncertainties associated with those locations. The Trustees have done so to the best of their knowledge and ability.

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LIST OF ACRONYMS AND ABBREVIATIONS

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CDE	Cornell Dubilier Electronics, Inc.
D&R	Delaware and Raritan
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FS	Feasibility Study
ft.	Foot (feet)
GIS	Geographic information system
IBI	Index of Biotic Integrity
IFW	Island Farm Weir
IPaC	Information for Planning and Consultation
NJDEP	New Jersey Department of Environmental Protection
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NRDAR	Natural Resource Damage Assessment and Restoration
NWI	National Wetlands Inventory
PCB	Polychlorinated biphenyls
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1. INTRODUCTION

The Cornell Dubilier Electronics, Inc. (CDE) Superfund Site is located in South Plainfield, Middlesex County, New Jersey (Figure 1-1) near the headwaters of Bound Brook, a tributary to the Raritan River. The release of hazardous substances from the CDE Site resulted in injuries to natural resources at adjacent wetlands, natural resources at Bound Brook and its unnamed tributary, and recreational fishing opportunities in adjacent waterways. Injured resources included similar habitats, species assemblages, and recreational opportunities as found in the larger Raritan River Watershed. The CDE Natural Resource Damage Assessment and Restoration (NRDAR) Trustee Council (the Trustees) is tasked with identifying and implementing ecological and recreational restoration projects that will restore, rehabilitate, replace, and/or acquire natural resources equivalent to those injured as a result of hazardous substance releases at the CDE Site. The objective of this restoration scoping effort is to identify potential restoration project opportunities within the Raritan River Watershed. The Trustees will use data gathered for this report, as well as information derived from other sources, to inform their formal restoration planning process. Through the formal restoration planning process, the Trustees will ultimately select suitable restoration projects for implementation. The selected projects may include those identified as part of this report, and/or may consist of other projects that the Trustees have identified in separate efforts.

The information gathered from survey respondents represents the best professional judgement of the survey respondents towards their submitted projects and does not necessarily reflect the viewpoint of the Trustees. Reporting discrepancies are to be expected in the early conceptual formation phase of projects. Project reporting of acres, stream miles, costs, benefits, and other uncertainties for example may differ from what may later be deemed as actual figures. The Trustees have made an effort to clarify and correct information with the help of the survey respondents whenever possible. Given the experience of the Trustees with projects of the type proposed in this watershed, and with the watershed itself, assistance was given towards establishing potential risks and uncertainties that may arise. The Trustees have done so to the best of their knowledge and ability. Inclusion of a project within this Scoping Report does not guarantee inclusion in subsequent Trustee restoration planning documents, nor does it guarantee funding or project implementation.

1.1 SITE BACKGROUND

Cornell Dubilier Electronics, Inc. manufactured electronic components, including capacitors, from 1936 to 1962 on a 26-acre property in South Plainfield, New Jersey. Polychlorinated biphenyls (PCBs), metals, and other hazardous substances were released from the facility due to poor waste handling and disposal practices. These releases resulted in the contamination of the surrounding environment, including adjacent wetlands as well as a stream on the property that flows into Bound Brook, a tributary of the Lower Raritan River. The U.S. Environmental Protection Agency (EPA) oversees Site remedial activities, and the Site's long-term cleanup is ongoing.

1.2 TRUSTEES RESPONSIBILITIES

The Federal and State NRDAR Trustees include the National Oceanic and Atmospheric Administration (NOAA), the U.S. Fish and Wildlife Service (USFWS), and the New Jersey Department of Environmental Protection (NJDEP). The Trustees are tasked with identifying and implementing ecological and recreational restoration projects that will restore, rehabilitate, replace, and/or acquire natural resources equivalent to those injured as a result of hazardous substance releases at the CDE Site.

The Trustees have engaged EA Engineering, Science, and Technology, Inc., PBC (EA) to compile information for cataloging potential ecological and recreational restoration opportunities in the Raritan River Watershed. The Trustees will use this information, as well as information derived from other sources, to inform their formal restoration planning process. The formal restoration planning process is a requirement under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) commonly known as Superfund. As part of this process, the Trustees will ultimately select suitable restoration projects for implementation. The projects may include those identified as part of this report, and/or may consist of other projects that the Trustees have identified in separate efforts. In accordance with CERCLA, the Trustees' final project selections will be submitted for public review and comment in the form of Draft and Final Restoration Plans.

1.3 POTENTIAL INJURIES TO NATURAL RESOURCES

PCBs and metals are the primary contaminants of concern from operations of the CDE facility. These hazardous substances were released into the surrounding environment, including adjacent wetlands and an unnamed stream on the CDE property that flows into Bound Brook, a tributary of the lower Raritan River. Hazardous substances likely migrated from source areas on the CDE Site to the wetlands, the unnamed stream, and Bound Brook via erosion, stormwater runoff, direct discharge, and groundwater migration. Elevated concentrations of contaminants were found in surface water, sediment, floodplain soils, fish, crayfish, and small mammals. The NJDEP issued a fish consumption ban in 1997 for all species in Bound Brook, due to PCB contamination.

1.4 SETTLEMENT SUMMARY

The United States has entered into several settlement agreements with potentially responsible parties for the CDE Site for injuries to natural and recreational resources due to the release of hazardous substances. Funds available from these settlements will be used to restore natural resources and recreational opportunities within similar habitats of the Raritan River Watershed.

2. REPORT OUTLINE

The remainder of this Restoration Scoping Report is organized as follows:

- *Section 3 – Restoration Scoping Effort:* describes the goal of the scoping process and report and the accepted restoration project categories
- *Section 4 – Restoration Scoping Methodology:* describes the data-gathering process for identifying potential stakeholders, requesting project submissions, and identifying restoration opportunities to highlight from the submitted projects
- *Section 5 – Restoration Opportunities within the Raritan River Watershed:* provides a narrative description of each of the 30 restoration opportunities profiled in the report.
- *Appendix A – Stakeholder Distribution List:* contains the contact information for each potential stakeholder for the requests for projects
- *Appendix B – Restoration Scoping Database:* contains the full restoration scoping database including all 95 unique project submissions

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3. RESTORATION SCOPING EFFORT

3.1 GOAL OF THE SCOPING PROCESS AND REPORT

The Trustees defined specific habitat and recreation/human use restoration project categories that will make the public whole for injuries to natural resources at the CDE Site (presented in Section 3.2). The potential restoration projects profiled in this report represent opportunities that may align with the restoration project categories defined by the Trustees.

Injured resources included similar habitats, species assemblages, and recreational opportunities as found in the larger Raritan River Watershed. The Trustees concluded that natural resource injury restoration should be completed within the greater Raritan River Watershed to provide opportunity for restoring habitats and recreational opportunities nearest to the injury area.

3.2 RESTORATION PROJECT CATEGORIES ACCEPTED

The Trustees sought project submissions related to specific habitat and recreation/human use restoration project categories. Within the habitat restoration category, the Trustees sought projects within 14 subcategories; within the recreational use category, the Trustees sought projects from within 6 subcategories, as listed below.

Eligible Habitat Restoration Project Categories:

- Tidal Wetland Restoration
- Tidal Freshwater Wetland
- Freshwater Wetland Restoration
- Technical Fish Passage (e.g., fish ladders, rock ramps, bypass channels)
- Dam Removal
- Submerged Aquatic Vegetation Restoration
- Oyster Restoration
- Riparian Restoration
- Floodplain Restoration
- Land Acquisition (parcels under imminent risk of development)
- Aquatic Connectivity (including culvert replacement)
- Freshwater Mussel Conservation and Enhancement
- Native Fish Conservation and Enhancement
- In-Stream Enhancement

Eligible Recreational Use Project Categories:

- Small Human-Powered Craft Launches
- River Trails
- Land Trails
- Interpretive Signage
- Docks and Piers

- Americans with Disabilities Act (ADA) Accessibility

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4. RESTORATION SCOPING METHODOLOGY

This section describes the data-gathering process for identifying potential stakeholders, requesting project submissions, and identifying the most appropriate restoration opportunities from the submitted projects.

4.1 STAKEHOLDER IDENTIFICATION

As the first step in the scoping process, the Trustees identified potential stakeholders within the Raritan River watershed that could have interest in creating, restoring, enhancing, or preserving habitats within the watershed, or interest in providing new or improved recreation and/or access within the watershed. The agencies represented by the Trustees Council participated in the project submission process along with 140 stakeholders who were contacted at the onset of the process. These 140 stakeholders represent all municipalities and counties in the watershed in addition to numerous other governmental organizations active in the Raritan. The Trustees identified potential stakeholders within the following categories:

- Non-governmental organizations
- Academic institutions
- State agencies
- Federal agencies
- Municipal and county government
- Public/private utility and governing boards.

Contact information for each potential stakeholder was entered into a database to form the stakeholder distribution list for the request for projects. The stakeholder distribution list is located in Appendix A.

4.2 STAKEHOLDER OUTREACH

Stakeholder outreach was performed as a multi-phased process, as described in the subsections below, to maximize the productive contact with each stakeholder and obtain as much information on each submitted project as possible.

4.2.1 Stakeholder Survey

A stakeholder survey was developed to be distributed electronically to stakeholders identified on a distribution list. The goal of the survey was to engage the stakeholders to submit project ideas that could be implemented within the Raritan River watershed and that were relevant to the Trustees' identified habitat and recreation/human use restoration project categories (Section 3.2). The survey format was an online form hosted on the NOAA Restoration Center database site. It was designed to capture 39 project data attributes; these attributes would later be used to populate a Restoration Scoping Database containing information on all projects received. Project data attributes requested by the Trustees fell within the following categories:

- Proponent organization and contact information
- Project title and brief description
- Project location
- Description/quantification of ecological or recreational benefit
- Current project status
- Cost estimate
- Available funding
- Potential project partners.

A link to the survey was included in an email distributed to all identified stakeholders. The email included a solicitation letter explaining the purpose of the survey, providing stakeholders with the targeted restoration categories that their project should fall within, and instructions on how to take the survey. Stakeholders were given 30 days to submit their projects, with no limit on the number of individual projects that could be submitted per stakeholder. In this initial email contact, stakeholders were asked to reply indicating if they intended to submit a project for consideration.

4.2.2 Follow-up Coordination

One week after the initial contact emails were sent to the stakeholders, a follow-up email was sent to those stakeholders who had not yet indicated if they would be submitting a project for consideration. If there was still no response one week after this follow-up email was sent, phone calls were made to the stakeholder to bring the survey request to the attention of the appropriate contact person. Following these phone calls, communication was discontinued with stakeholders who indicated they would not be completing a survey and stakeholders who had yet to respond.

For the stakeholders who had answered yes to the survey request, Trustees followed up with them via phone call as a reminder to submit their proposed projects in time. The phone calls served as both a reminder of Trustees' request for projects, as well as an opportunity to provide more information to the stakeholders and answer any questions they had about the scoping process. During these phone calls, stakeholders were made aware that restoration projects must be consistent with the requirements of CERCLA and the NRDAR regulations.

As the deadline for submissions approached, a second round of follow-up phone calls was made only to those stakeholders who had indicated in previous contact that they intended to submit a project but had not yet taken the stakeholder survey.

4.3 RESTORATION SCOPING DATABASE

After the project submission deadline had passed, all project information collected through the stakeholder survey was populated into a database. This database was comprised of 67 total variables that contained specific project information; these variables were designed to assist the Trustees in evaluating submitted projects for feasibility, and in selecting a subset of total submitted projects for inclusion in this report.

The Trustees received 112 total project submissions from stakeholders; however, 17 were found to be duplicate entries, where the same project was submitted by one or more different stakeholders. For each project entry with a duplicate, the duplicate entries were evaluated for thoroughness of submitted information; the entry with the most relevant and complete information was kept, and the other duplicate(s) were removed from the database.

The Trustees evaluated all projects and narrowed the database through a stepped process to what would ultimately be the 30 projects profiled in this report. (Figure 4-1). These 30 entries were identified by the Trustees as compatible with the defined habitat and recreation/human use restoration project categories. Initially, a subset of 69 of the 95 unique projects was identified. The 69 projects were then evaluated by spatial extent within the Raritan River watershed; this evaluation allowed the Trustees to gain a geographical sense of the extent of the subset of projects and proved a useful tool for further refining the list of projects. Using these data, the Trustees then identified 30 of the 69 projects that would serve as the final list of restoration opportunities to be profiled in the report and expanded upon in the restoration scoping database (Figure 4-1).

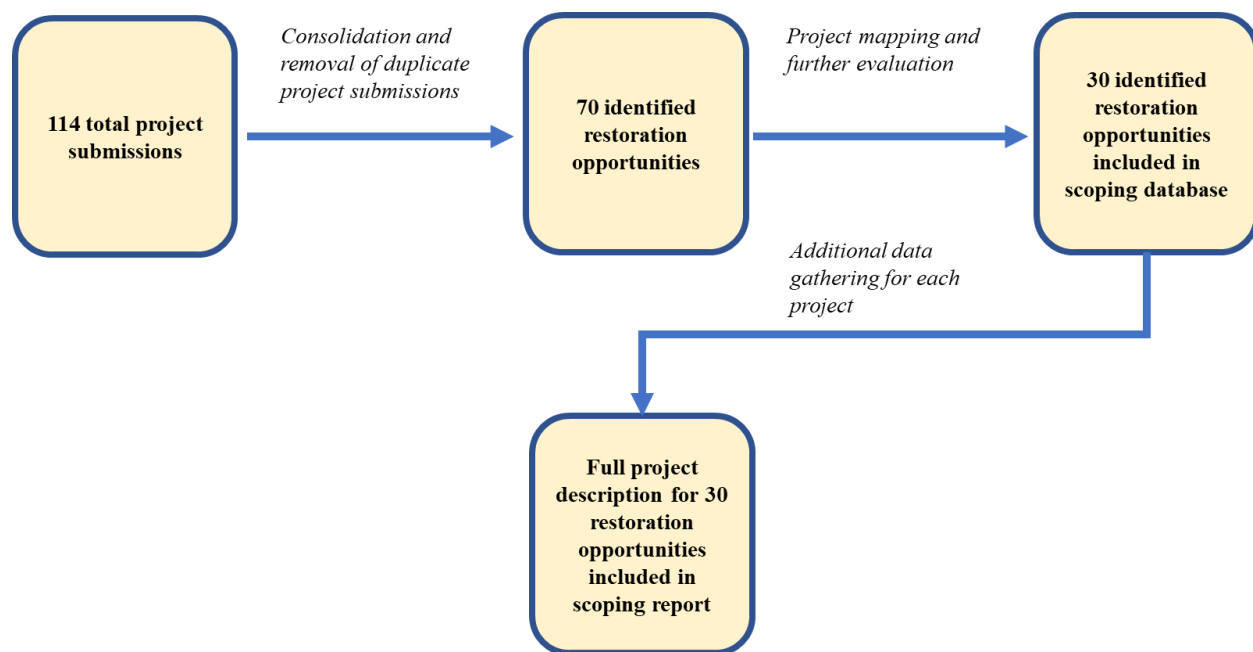


Figure 4-1 Restoration Opportunity Identification Process

Following identification of the final 30 restoration opportunities, each representative project stakeholder was contacted if additional information was needed to fill data gaps in the necessary project information. Some of the data gaps that existed for some projects included potential project risks, acreages of habitat restored/enhanced/protected, and actions already taken for the project. Of the final 30 restoration opportunities, over half were dam removal/fish passage projects and projects that aimed to restore aquatic habitat, water quality, and riparian/wetland buffer zones (Figure 4-2). Four projects were wetland restoration or creation projects, and five

were recreational enhancement projects. These projects were proposed by a mix of both federal agencies and non-governmental organizations, and state agencies, academic institutions and local municipalities within the Raritan River watershed (Figure 4-3). The locations of the 30 restoration opportunities is presented on Figure 4-4.

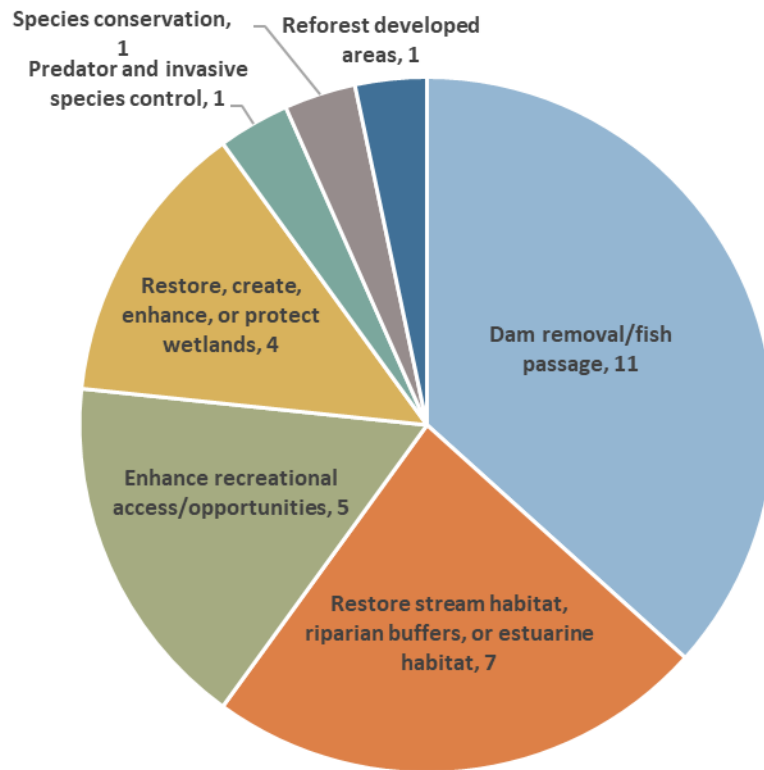


Figure 4-2 Restoration Project Types within the Final 30 Identified Projects

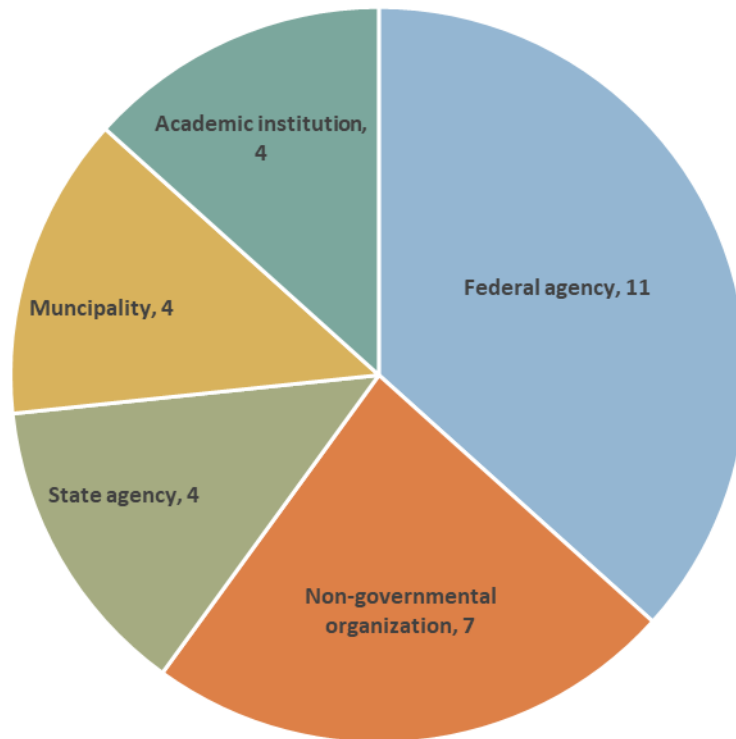


Figure 4-3 Stakeholder Diversity within the Final 30 Identified Projects

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5. RESTORATION OPPORTUNITIES WITHIN THE RARITAN RIVER WATERSHED

The full restoration scoping database containing all 112 project submissions is included in Appendix B. This database also includes the list of 69 projects that the Trustees first identified as potential restoration opportunities, as well as all the data for the list of 30 projects that the Trustees have identified and profiled in this report as most compatible with the Trustees defined habitat and recreation/human use restoration project categories.

This section presents a complete project description for each of the 30 final profiled projects. Each project subsection contains a narrative and accompanying maps (included at the end of this report), developed using the data provided by the project stakeholder; additional relevant and appropriate research; and geospatial data within and surrounding the boundary of each project area. Resources used specific to each project are included at the end of the respective subsection. It is important to note that the level of detail in each of the 30 project descriptions vary widely based on the available existing information.

Many of the resources used in this process were applied to most project descriptions, as appropriate; these include the National Wetlands Inventory (NWI) data hosted by USFWS, results from online project area reviews conducted through the USFWS Information for Planning and Consultation (IPaC) tool, and numerous geographic information system (GIS) data layers.

The NWI—The NWI was established by USFWS to conduct a nationwide inventory of U.S. wetlands and provide biologists and others with information on the distribution and type of wetlands to aid in conservation efforts. To do this, the NWI developed a wetland classification system (Cowardin et al. 1979¹) that is now the official USFWS wetland classification system and the federal standard for wetland classification. For each project described in this section, the NWI layers were added for the area within the project footprint and immediately surrounding the project footprint, as appropriate (some projects were not sited in areas with wetland habitat).

USFWS IPaC Tool—The IPaC online project review tool allows a user to define a project area and returns a list of potentially present federally listed species and critical habitats. This tool aims to streamline project review by USFWS and supports consultation under the Endangered Species Act (ESA). For each habitat restoration project described in this section, an IPaC review was performed. For some of these projects, the stakeholder identified if any federally or state-listed threatened or endangered species were present in their project area (or were the target species to receive benefit from the project). For other projects, this was a data gap and, thus, performing an IPaC review for all projects ensured that any and all protected species and critical habitats potentially within the project footprint were identified.

¹ Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Department of the Interior, Fish and Wildlife Service, Office of Biological Services, Washington, D.C.

Additional GIS Data Layers—The following GIS data were incorporated into the project descriptions, as appropriate. Depending on the project location within the Raritan River watershed, not all data appear on maps for each project.

- Falcone, J. 2011. *GAGES-II: Geospatial Attributes of Gages for Evaluating Streamflow*. U.S. Geological Survey, Reston, Virginia.
- Franken, J. 2005. *NJDEP Ambient Lakes Monitoring Network in New Jersey, 2005*. NJDEP, Water Monitoring and Standards, Bureau of Freshwater and Biological Monitoring, Trenton, New Jersey.
- Marion, C. 2019. *Boating Access Points in the Raritan Watershed*. USFWS New Jersey Field Office, Galloway, New Jersey.
- Marion, C. 2019. *Dams in the Raritan Watershed*. USFWS New Jersey Field Office, Galloway, New Jersey.
- New Jersey Office of Information Technology, Office of Geographic Information Systems. No date. *Counties in New Jersey*.
- New Jersey Office of Information Technology, Office of Geographic Information Systems. No date. *Municipalities in New Jersey*.
- NJDEP. 2018. *New Jersey State Park Service. Parks and Forests Trail System*. NJDEP.
- NJDEP. 2018. *State Protected Open Space (Generalized) and Recreation Areas in New Jersey*.
- NJDEP. No date. *Fish Index of Biotic Integrity Monitoring Network (2000 to 2001)*.
- New Jersey Office of Information Technology, Office of Geographic Information. 2018. *Parcels Composite of New Jersey*.
- U.S. Census Bureau. 2017. *2017 Congressional Districts in New Jersey*.
- USFWS. 2018. *The National Wetlands Inventory. Version 2, Surface Waters and Wetlands Inventory*.
- USGS. 2017. *Hydrologic Units within the Watershed Boundary Dataset*.
- USGS. 2017. *National Hydrography Dataset*.

5.1 ISLAND FARM WEIR DAM PASSAGE (PROJECT 1)

5.1.1 Project Stakeholder(s)

The Island Farm Weir (IFW) Dam Passage project was proposed by NJDEP. Potential project partners may include the New Jersey Water Supply Authority and a private partner.

5.1.2 Project Location and Background

The IFW is located southwest of the CDE Superfund Site, on the mainstem of the Raritan River within the lower Raritan River watershed, and between the townships of Bridgewater and Franklin (Figure 5-1a). Other dams along this section of the Raritan River have been removed in recent years, but the mainstem river is still impounded by both IFW and Headgates Dam (NOAA 2016). There are five Fish Index of Biotic Integrity (IBI) sampling locations to the north and west of the project site, and ten New Jersey Ambient Biomonitoring Network sites. Four boating access points are in the vicinity of the project area, one to the southeast of the site within a residential area, and three along the river within the Delaware and Raritan Canal State Park (Figure 5-1a).

Improvements at IFW would continue recent efforts to restore natural flow in the lower watershed and reduce fish passage impediments. An on-going study, now in its seventh year, is being conducted by NJDEP and the Rutgers University Jensen Marine Lab in order to test the effectiveness of the existing fish passage structure constructed in 1995. Results of the passage study are preliminary. The need for improvements to the IFW was described in a NRDAR Restoration Plan/Environmental Assessment for a nearby location (NOAA 2016). An evaluation of fish passage alternatives and technical feasibility is underway. The downstream Calco Dam in Bridgewater was removed in 2011, followed by the upstream Roberts Street Dam in Bridgewater and Hillsborough in 2012, and the Nevius Street Dam in Raritan Borough in 2013 (NJ.com 2017). Since the removal of the Calco Dam in 2011, the IFW is the first impediment fish encounter in their migration into the Raritan River. The IFW is not a candidate for removal because the river section it impounds contains supply intakes operated by the New Jersey Water Supply Authority.

5.1.3 Proposed Restoration Action

Improvement of fish passage at the IFW would compensate for the losses of natural biological functions within the Raritan River watershed resulting from the CDE Superfund Site. Improvements would be made to the fish ladder and/or construction of a rock ramp at the location.

The proposed action is a **fish passage** project to **enhance** riverine habitat. Alternatives for fish passage have been evaluated in detail in the Alternatives Analysis for the Island Farm Weir (Kleinschmidt 2017); they are briefly discussed here. Specific project components may include one or more of the following:

- Addition of vertical slot fish ladder modifications
 - Improve fish passage by modifying existing fishway in current location
 - Poor attraction of shad and river herring documented due to low attraction flow at ladder
 - Vertical wall diffusers would be added in the south sediment bypass channel, downstream of fishway entrance to improve flow
- Construction of a nature-like channel in bypass channel
 - Creation of nature-like channel in the existing sediment bypass channel
 - Existing fishway would be converted to a bypass channel to maintain ability to direct river flow around the IFW
 - Design would be based on Fish Passage Engineering Design Criteria (USFWS 2017) Entrance would need to be carefully placed to maintain high attraction and avoid creation of dead zone of water between flow over the IFW and flow exiting the fishway
- Construction of new pool and weir elements in a sediment bypass channel
 - Creation of new pool and weir style fishway in existing sediment bypass channel
 - Not highly recommended for this site due to engineering concerns
- Construction of a full width rock ramp
 - Design would consist of well-graded rock fill and soil to create a series of pools and rock weirs with velocities suitable for fish passage within the rock ramp
 - Low-flow channel established to convey exceedance flow and maintain suitable fish passage
 - Creation of a multi-stage channel to provide suitable passage velocities under a range of flow conditions
 - Rock ramp design would follow Fish Passage Engineering Design Criteria (USFWS 2017)

5.1.4 Site Conditions

The project site is bounded by both private and publicly owned lands. The dam itself and land parcel to the north are privately owned, while the parcel to the south is owned by NJDEP (Figure 5-1b). In general, the study area communities contain a mix of suburban residential development, industrial facilities, and commercial highway corridors.

The habitat immediately surrounding IFW is forested scrub/shrub wetland (Figure 5-1c). The project site is located within the 100-year floodplain (Figure 5-1c).

Downstream of the IFW, the Raritan River contains many migratory diadromous fish species. Upstream of the IFW where the confluence of the Millstone River and Raritan River split the Raritan into large sub-watersheds, smaller numbers of migratory fish species are found, including American Shad (*Alosa sapidissima*), Blueback Herring (*Alosa aestivalis*), Alewife (*Alosa pseudoharengus*), Sea Lamprey (*Petromyzon marinus*), Gizzard Shad (*Dorosoma cepedianum*), American Eel (*Anguilla rostrata*), and Striped Bass (*Morone saxatilis*) (NOAA 2016). The base of the Headgates Dam marks the furthest extent of passage on the Raritan. The Blackwells Mills Dam marks the furthest extent of passage on the Millstone. The target species to benefit from this project are presented in Table 5-1a.

Table 5-1a Target Species for the Island Farm Weir Passage Project

Species Name	Type	Federal/State Listed Status
American Shad (<i>Alosa sapidissima</i>)	Fish	Not listed
Blueback Herring (<i>Alosa aestivalis</i>)	Fish	In review for listing under the ESA
American Eel (<i>Anguilla rostrata</i>)	Fish	Not Listed
Sea Lamprey (<i>Petromyzon marinus</i>)	Fish	Not Listed
Striped Bass (<i>Morone saxatilis</i>)	Fish	Not Listed
Alewife (<i>Alosa pseudoharengus</i>)	Fish	Not Listed

5.1.5 Natural Resource and Human Use Benefits

Significant natural resource benefits would occur as part of this project. Implementation of the IFW Passage Project would result in the enhancement of approximately 14.3 miles of riverine habitat. This habitat would become more easily accessible to migratory fish entering the Raritan River (Table 5-1c). The main goal of most fish passage projects is to provide access to historical spawning, rearing, and migration habitats necessary for diadromous species to complete their life cycles and to make accessible those seasonal habitats necessary to contribute to the enhancement of the stocks. Modifications to river barriers that aim to improve effective passage of migrating adults and juveniles past the barriers are designed to meet that goal. Implementation of improved fish passage at IFW would benefit American Shad, Blueback Herring, and American Eel (along with other migratory fishes), each of which have declining populations throughout the United States Northeast, largely due to reduced access to suitable habitat (Atlantic States Marine Fisheries Commission 2009). Improved access to 14.3 miles of stream channel is a start to increasing distribution of the migratory species.

Table 5-1c Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit(s) Gained
Riverine	14.3 miles	Hydrologic connectivity, access to habitat for migratory fish, including spawning habitat

Local residents could also benefit from passage improvements at IFW. Improved distribution, genetic diversity, and stock population of diadromous fish utilizing the stream within and upstream of the project area could increase recreational fishing opportunities within the area. Passage improvements often also result in improved water quality in the impounded area through better hydrologic connectivity and restoration of ideal water temperatures below the dam (Bednarek 2001). Additionally, an improved fish population utilizing their seasonal habitats would help to support a healthy functioning food web, resulting in an overall healthier stream to support recreational uses.

5.1.6 Project Risks and Uncertainties

This project has potential risks/infeasibilities regarding site access, design engineering, permitting, and cost to complete. Permissions must be secured from the owner and operators along with project concurrence from all state agencies and authorities. The technical feasibility and viability of fish passage options under consideration at this site have not yet been made public. The cost of this project is therefore unknown but is expected to well exceed \$1 million. The project benefit has been partially determined by the number of migratory fish failing to make upstream passage at the current fish ladder as demonstrated by the preliminary results of an extensive seven year study by the Rutgers University Marine Science Jensen Lab.

5.1.7 Resource Materials

Resources used in addition to those described in Section 5.1 include:

Atlantic States Marine Fisheries Commission (ASMFC). 2009. *Atlantic Coast Diadromous Fish Habitat: A Review of Utilization, Threats, Recommendations for Conservation, and Research Needs*. Habitat Management Series #9. January.

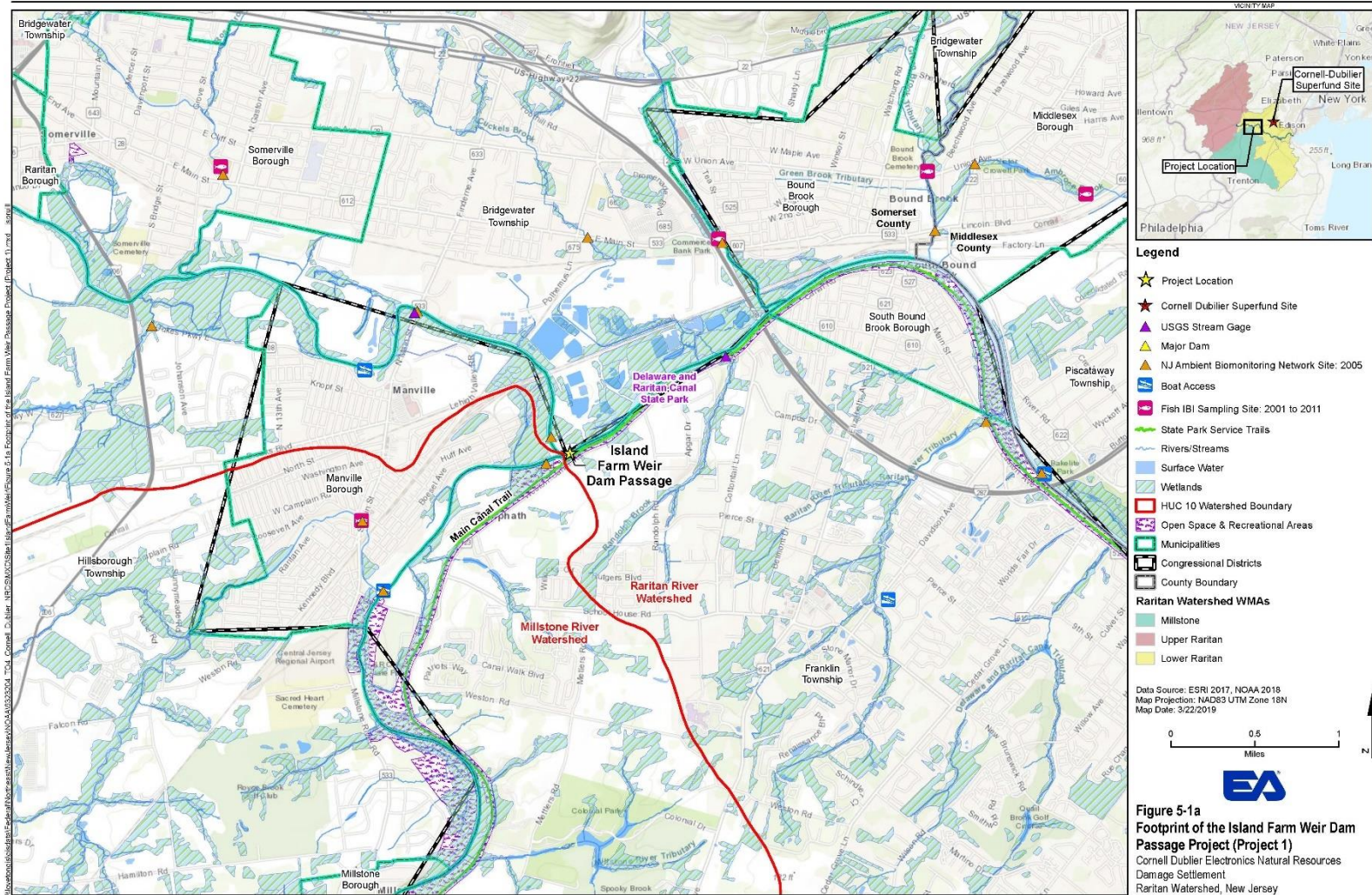
Bednarek, A. 2001. Undamming rivers: A review of the ecological impacts of dam removal. *Environ. Manage.* 27(6):803-814.

Kleinschmidt. 2017. *Alternatives Analysis for the Island Farm Weir Fish Passage Enhancements*. November.

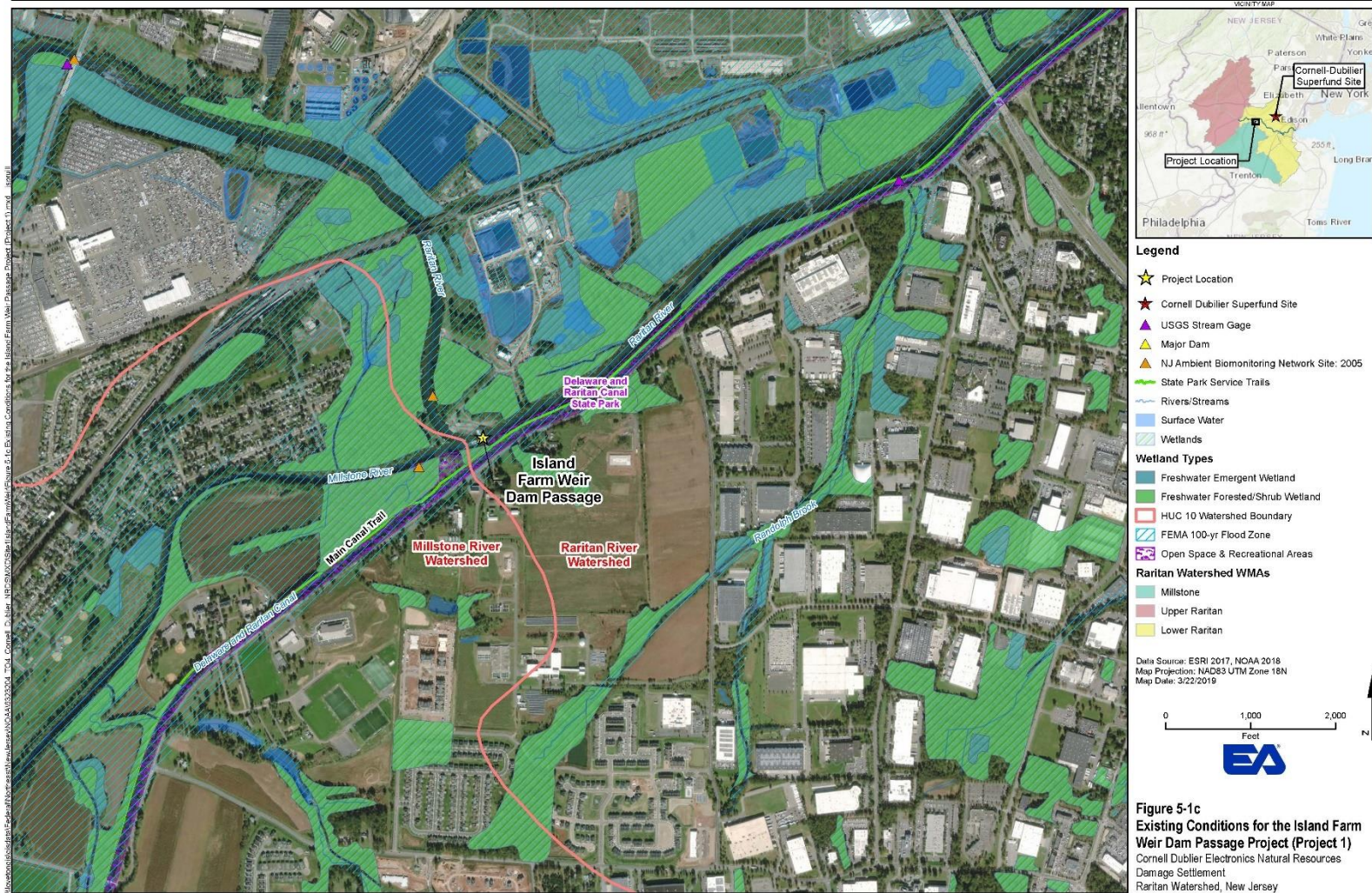
NJ.com. 2017. Dam removal will help bring Raritan River Back to Life. https://www.nj.com/somerset/2017/08/dam_removal_will_benefit_fish_environment_and_recr.html. 10 August.

NOAA. 2016. *In-River Restoration Plan/Environmental Assessment for the American Cyanamid Co. Superfund Site, Bridgewater Township, Somerset County, New Jersey*. Final. October.

USFWS. 2017. Fish passage engineering design criteria. USFWS, Northeast Region, R5, Hadley Massachusetts.







5.2 HEADGATES DAM REMOVAL (PROJECT 2)

5.2.1 Project Stakeholder(s)

The Headgates Dam Removal project was proposed by NJDEP. Potential project partners may include Stantec, Inc., Bridgewater Township, Somerset County, and Duke Farms.

5.2.2 Project Location and Background

The Headgates Dam is located west of the CDE Superfund Site, on the mainstem of the Raritan River within the Raritan River watershed, and between the townships of Bridgewater and Branchburg (Figure 5-2a). There are five Fish IBI sampling locations surrounding the project site, one New Jersey Ambient Biomonitoring Network site, and four boating access points. The Raritan River Confluence Park is also adjacent to the project site (Figure 5-2a). There are three major dams upstream and one major dam downstream of the site.

Headgates Dam is a 235-foot (ft.)-wide, run-of-the-river dam located on the Raritan River at river mile 29.9. The height of the dam is approximately 14 ft. as measured from the top of the south wing wall at the abutment to the streambed at the toe of the apron (Louis Berger 2014). In the past 4 years, three low-head dams (Robert Street, Nevius, and Calco) have been removed downstream of Headgates Dam, leaving IFW the only remaining dam between Headgates Dam and the Atlantic Ocean.

In the Feasibility Study (FS) for this project (Louis Berger 2014), NJDEP identified four options to be evaluated to accommodate fish passage at Headgates Dam: dam removal, rock ramp, bypass channel, and fish ladder. This project is part of a larger long-range program to restore diadromous fish to the Raritan River and its tributaries. The removal of Headgates Dam ranked the highest in the FS amongst the options in meeting the overall goal of the study and was the preferable option. The purpose of this removal is to allow native anadromous and catadromous fish populations to reach upstream areas in the Raritan River that are currently inaccessible due to the dam. These key species are American Shad (*Alosa sapidissima*), Alewife (*Alosa pseudoharengus*), American Eel (*Anguilla rostrata*), Blueback Herring (*Alosa aestivalis*), Striped Bass (*Morone saxatilis*), and Sea Lamprey (*Petromyzon marinus*).

5.2.3 Proposed Restoration Action

Removal of the Headgates Dam would assist in compensating for the losses of natural biological functions within the Raritan River watershed resulting from the CDE Superfund Site impacts. Removal of this barrier would open river access to migratory fish.

The proposed action is a **fish passage** project to **enhance** riverine habitat and include potential wetland restoration. Specific project components would include:

- Removal of Headgates Dam;
- Restoration of the river channel and banks;
- Rerouting of the existing municipal sewerage pipe that is immediately upstream of the dam, as this would be exposed through the dam removal; and
- Replacement of the source water for the Raritan Water Power Canal (current source is water from the Headgates Dam impoundment).

5.2.4 Site Conditions

The project site is located in a parcel owned by Somerset County, New Jersey. It is surrounded by public parcels also owned by Somerset County, as well as a parcel to the west owned by NJDEP (Figure 5-2b). In general, the study area is comprised of forested tracts, open space, and residential communities.

The habitat immediately surrounding Headgates Dam is freshwater emergent wetland (Figure 5-2c). However, there are larger areas of forested scrub/shrub wetland and freshwater emergent wetland present in surrounding areas. The project site is located within the 100-year floodplain (Figure 5-2c).

American Shad, Alewife, American Eel, and Blueback Herring are the target species to benefit from this project (Table 5-2a). They are depleted throughout much of their Mid-Atlantic and New England range (Atlantic States Marine Fisheries Commission 2009). These species have historical presence within the Raritan River and, thus, efforts to allow their populations to increase to historical levels are a priority to state and federal agencies responsible for these resources (Louis Berger 2014).

Table 5-2a Target Species for the Headgates Dam Removal Project

Species Name	Type	Federal/State Listed Status
American Shad (<i>Alosa sapidissima</i>)	Fish	Not listed
Blueback Herring (<i>Alosa aestivalis</i>)	Fish	In review for listing under the ESA
Alewife (<i>Alosa pseudoharengus</i>)	Fish	Not listed
American Eel (<i>Anguilla rostrata</i>)	Fish	Not Listed
Sea Lamprey (<i>Petromyzon marinus</i>)	Fish	Not Listed
Striped Bass (<i>Morone saxatilis</i>)	Fish	Not Listed

5.2.5 Natural Resource and Human Use Benefits

Significant natural resource benefits would occur as part of this project. Implementation of the Headgates Dam Removal project would result in the enhancement of approximately 16.8 miles of riverine habitat. This habitat would become more easily accessible to migratory fish entering the Raritan River (Table 5-2c). Removal the Headgates Dam would benefit migratory and diadromous fish species, especially after fish passage issues is improved at the nearby IFW. The main goal of fish passage projects is to provide access to historical spawning, rearing, and migration habitats necessary for diadromous species to complete their life cycles and to make accessible those seasonal habitats necessary to contribute to the enhancement of the stocks. Removal of river barriers would aim to improve effective passage of migrating adults and

juveniles past the barriers. Implementation of this project would benefit American Shad, Blueback Herring/ Alewife, and American Eel (along with other migratory fishes), each of which have declining populations throughout the United States Northeast, largely due to reduced access to suitable habitat (Atlantic States Marine Fisheries Commission 2009). Improved access to 16.8 miles of stream channel is a start to increasing distribution of these migratory species. Additionally, this project may also include areas of wetland restoration surrounding the dam location, which would provide suitable habitat for a host of wildlife and aquatic organisms.

Table 5-2c Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit(s) Gained
Riverine	16.8 miles	Hydrologic connectivity, access to habitat for migratory fish, including spawning habitat

The local community could also benefit from removal of the Headgates Dam. Improved distribution, genetic diversity, and stock population of diadromous fish utilizing the stream within and upstream of the project area could increase recreational fishing opportunities within the area. Passage improvements often also result in improved water quality in the impounded area through better hydrologic connectivity and restoration of ideal water temperatures below the dam (Bednarek 2001). Additionally, an improved fish population utilizing their seasonal habitats would help to support a healthy functioning food web, resulting in an overall healthier stream to support recreational uses.

5.2.6 Project Risks and Uncertainties

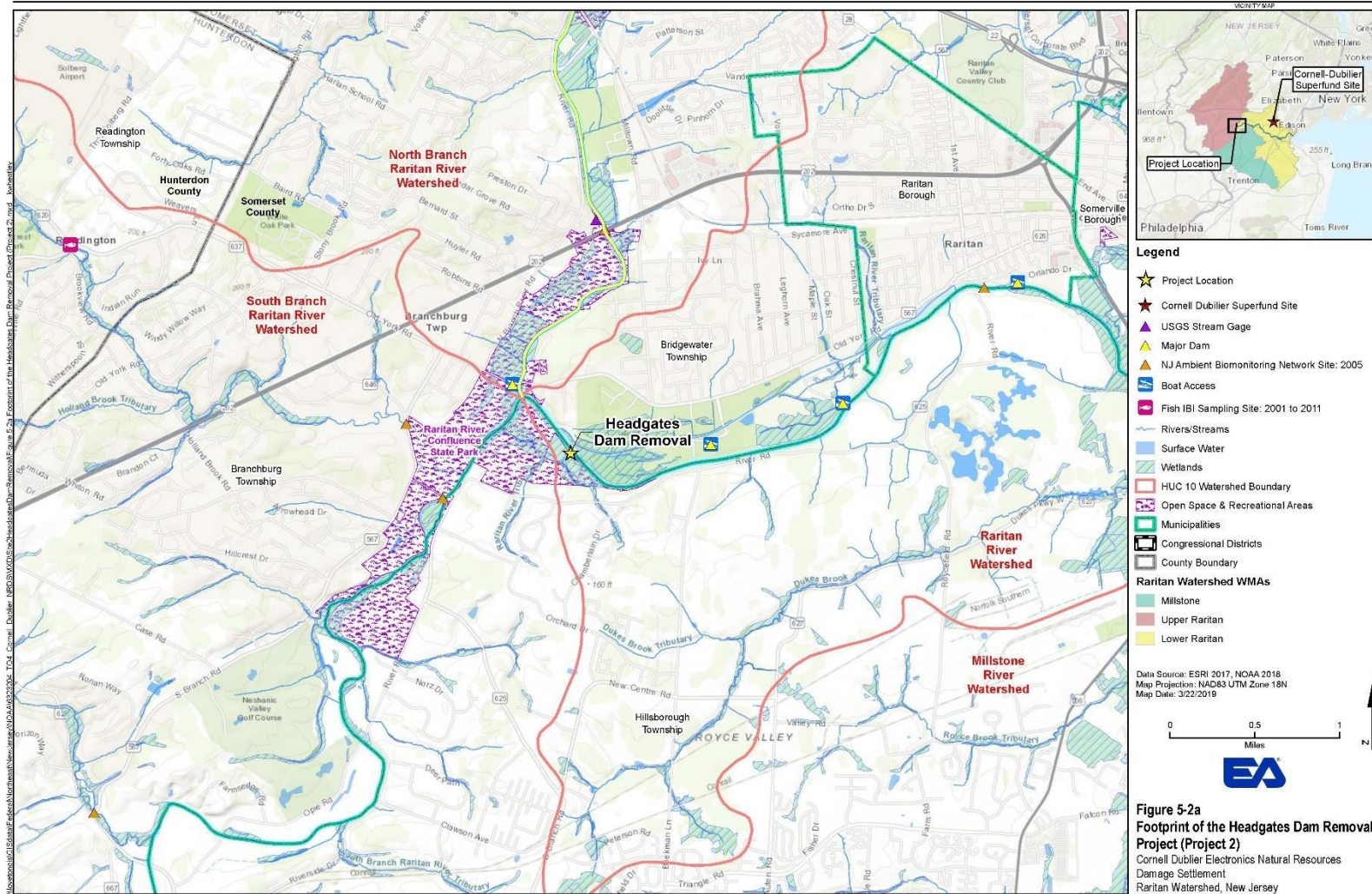
This project has potential risks and infeasibilities associated with engineering, political/social considerations, and cost to complete. The Headgates Dam backs up water to divert flows into the Raritan Water Power Canal via a culvert located upstream of the dam (Louis Berger 2014); removal of the dam may interrupt water supply to the Power Canal. The municipal sewerage line situated a few hundred feet above the dam may need to be relocated/buried and may require a pump station to accommodate dam removal. The cost of this project is unknown, but is expected to exceed \$4 million. The success of this project is partially contingent on improving passage at IFW (Project 1).

5.2.7 Resource Materials

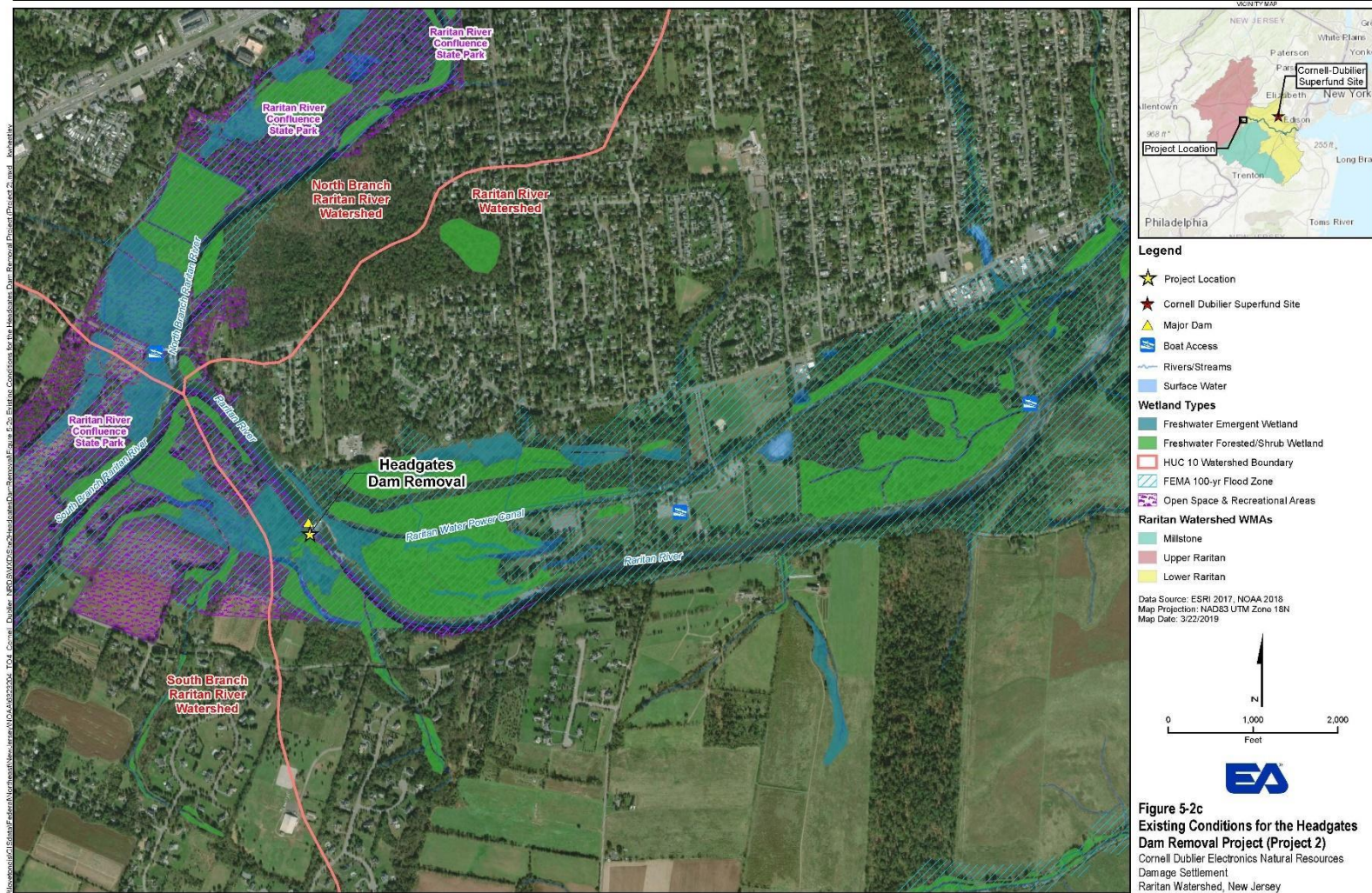
Resources used in addition to those described in Section 5.1 include:

Bednarek, A. 2001. Undamming rivers: A review of the ecological impacts of dam removal. *Environ. Manage.* 27(6):803–814.

Louis Berger. 2014. *NJDEP Green Acres Program Headgates Dam Fish Passage Feasibility Study*. Final.







5.3 ROCKAFELLOW MILLS DAM REMOVAL (PROJECT 3)

5.3.1 Project Stakeholder(s)

The Rockafellow Mills Dam Removal project was proposed by USFWS and maybe supported by Raritan Headwaters Association, New Jersey Trout Unlimited, Readington Township, Raritan Township, and Hunterdon County. The dam is privately owned, and the landowners are currently disinterested in removing the dam. There has been no action taken on this project to date.

5.3.2 Project Location and Background

The Rockafellow Mills Dam Removal (Project 3) is a proposed dam removal project located on the South Branch Raritan River between Readington Township and Raritan Township, Hunterdon County, New Jersey (Figure 5-3a). Adjacent to the project site is a 500-acre tract of the South Branch Wildlife Management Area. This project site is in the South Branch Raritan River watershed, within the Upper Raritan New Jersey Watershed Management Area.

This run-of-the-river rock fill concrete gravity dam is 90 ft. long and 14 ft. high and impounds approximately 74 acres. The dam is the most downstream obstruction on the South Branch Raritan River and is obstructing migratory and diadromous fish passage. However, based on satellite imagery, the dam structure appears to be partially breached, which may allow some degree of fish passage. The structure also appears to be causing erosion on the left streambank as one views from upstream looking downstream. Proposed restoration activities include dam removal and restoration of the riparian corridor in the vicinity of the dam. No action to date has been taken on this project, and general reconnaissance will be needed to assess the feasibility of removing the obstruction.

5.3.3 Proposed Restoration Action

The proposed action is a **dam removal** project to **enhance** stream habitat and riparian buffer in the vicinity of the removed dam. Specific project components would include:

- General reconnaissance of the dam structure;
- Dam removal;
- Restoration of riparian corridor in the vicinity of the dam; and
- Preservation of open space adjacent to dam.

5.3.4 Site Conditions

The land within the project site is comprised of four private parcels (Figure 5-3b). The existing wetland habitat within the project site consists of 5.11 acres of freshwater emergent and freshwater forested/shrub wetlands (Figure 5-3c). The entirety of the project footprint is located within the 100-year floodplain.

Implementation of this project would primarily benefit diadromous and migratory fish from improved habitat (Table 5-3a). There would likely be benefits to other aquatic species due to improved water quality following dam removal.

Table 5-3a Target Species for the Rockafellow Mills Dam Removal Project

Species Name	Type	Federal/State Listed Status
American Shad (<i>Alosa sapidissima</i>)	Fish	Not listed
Blueback Herring (<i>Alosa aestivalis</i>)	Fish	In review for listing under the ESA
Alewife (<i>Alosa pseudoharengus</i>)	Fish	Not listed
American Eel (<i>Anguilla rostrata</i>)	Fish	Not Listed
Sea Lamprey (<i>Petromyzon marinus</i>)	Fish	Not Listed
Striped Bass (<i>Morone saxatilis</i>)	Fish	Not Listed

5.3.5 Natural Resource and Human Use Benefits

Implementation of the Rockafellow Mills Dam Removal project would result in approximately 9.3 linear stream miles of habitat enhancement and 1 to 3 acres of enhanced riparian buffer (Table 5-3b).

Table 5-3b Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Instream Habitat	9.3 miles	Erosion control, fish passage, improved water quality
Riparian Buffer	1-3 acres	Restoration of riparian buffer in vicinity of dam removal

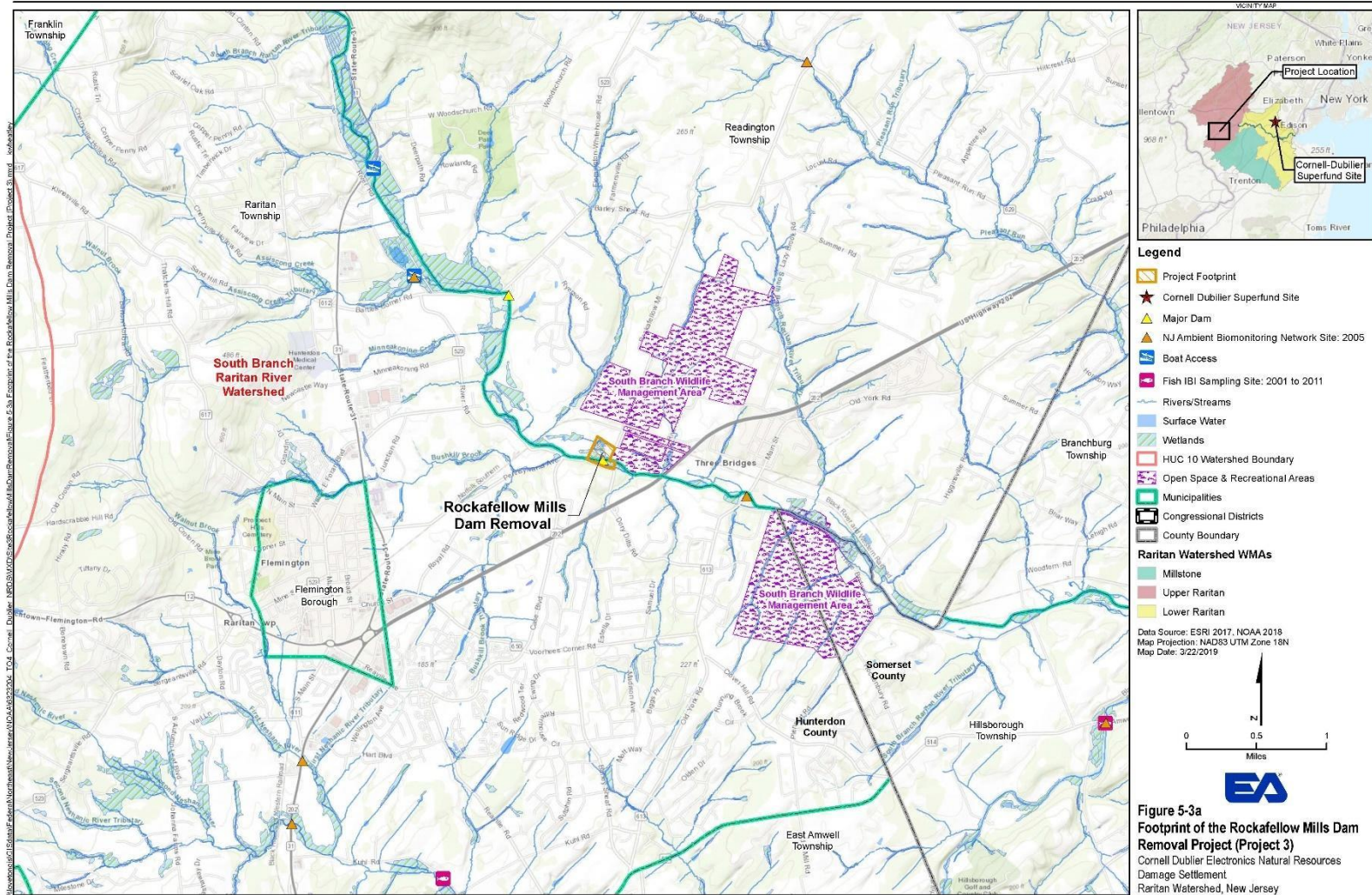
Removal the Rockafellow Mills Dam would benefit migratory and diadromous fish species, especially after fish passage issues is improved at the nearby IFW and Headgates Dam. Restoration of the riparian corridor in the vicinity of the dam would benefit aquatic habitat and improve habitat connectivity to the South Branch Wildlife Management Area.

5.3.6 Project Risks and Uncertainties

This project has potential risks/infeasibilities regarding site access, political/social concerns, and cost to complete. The project site is located entirely on privately owned land, and the property owners have not expressed interest in the project. In addition, there is little information characterizing the project site. Much of the assumptions regarding this project would need to be verified before any restoration actions take place, most likely through a detailed feasibility study. The cost of this project is unknown but expected to be less than \$1 million.

5.3.7 Resource Materials

No additional resource materials were available for this project.







5.4 KLINE'S MILL DAM REMOVAL (PROJECT 4)

5.4.1 Project Stakeholder(s)

The Kline's Mill Dam Removal project was proposed by USFWS. Ownership of the dam is uncertain at this time but gives the appearance of a remnant mill dam. No action has been taken on this project to date.

5.4.2 Project Location and Background

The Kline's Mill Dam Removal (Project 4) project is located on the North Branch Raritan River in Bedminster Township, Somerset County, New Jersey (Figure 5-4a). There is a Fish IBI sampling site approximately 0.5 mile upstream of the project site, and another, paired with a New Jersey Ambient Biomonitoring Network site approximately 1 mile downstream. There are also two downstream USGS stream gauges. One approximately 2.9 miles downstream of the dam site on the Lamington River at Burnt Mills Rd. The other approximately 1.0 miles downstream on the Middle Brook tributary (USGS National Water Inventory). The Kline's Mill Dam Removal project site is in the North Branch Raritan River watershed, within the Upper Raritan Watershed Management Area.

The dam itself appears to be fully intact, is approximately 100 ft. long, concrete, and run-of-river. The dam was presumably part of the McDonalds/Kline's Mills, originally an "up and down" sawmill that operated on the site as early as 1744. The dam likely underwent structural repairs and/or modifications during the following century, as there is evidence that the site housed both a gristmill and sawmill in the mid-1800s.

5.4.3 Proposed Restoration Action

The proposed action is a **dam removal** project to **enhance** stream habitat. Specific project components would include:

- General reconnaissance of the dam structure; and
- Dam removal.

5.4.4 Site Conditions

The Kline's Mill Dam is located on the North Branch Raritan River between a public parcel owned by Bedminster Township to the north and a private parcel to the south (Figure 5-4b). The property owned by Bedminster Township is gated and inaccessible by car, and the private parcel is a preserved farmland block. The preserved farmland block was included as a proposed acquisition in the 2003 Master Plan for Bedminster Township, and was apparently preserved sometime between 2003 and 2010. The accompanying McDonalds/Kline's Mills building (restored) and original mill drive structures are located 0.2 miles downstream of the dam off Kline's Mill Road, a scenic roadway that is closed to the public. The Mill itself is privately

owned and listed on the National Register of Historic Places. Freshwater forested/shrub wetlands surround the project site (Figure 5-4c).

Implementation of this project would benefit migratory fish species after fish passage issues are addressed at IFW, Headgates Dam, and Mill Street Dam (Table 5-4a). There is also potential for cold-water-dependent fish species uplift. Following dam removal, there will be a net benefit to water quality, which will likely improve habitat for several state-listed mussel species.

Table 5-4a Target Species for the Kline's Mill Dam Removal Project

Species Name	Type	Federal/State Listed Status
American Shad (<i>Alosa sapidissima</i>)	Fish	Not listed
Blueback Herring (<i>Alosa aestivalis</i>)	Fish	In review for listing under the ESA
American Eel (<i>Anguilla rostrata</i>)	Fish	Not Listed

5.4.5 Natural Resource and Human Use Benefits

Implementation of the Kline's Mill Dam Removal project would result in 5.7 miles of enhanced instream habitat by permitting passage of migratory fish and improving water quality (Table 5-4b).

Table 5-4b Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Instream Habitat	5.7 miles	Fish passage, improved water quality

Removal of Kline's Mill Dam would benefit migratory and diadromous fish species, especially once fish passage issues are addressed at IFW, Headgates Dam, and Mill Street Dam. There is also a potential for cold-water fish species uplift following dam removal. This project would have a net benefit to water quality, likely improving habitat for freshwater mussel species.

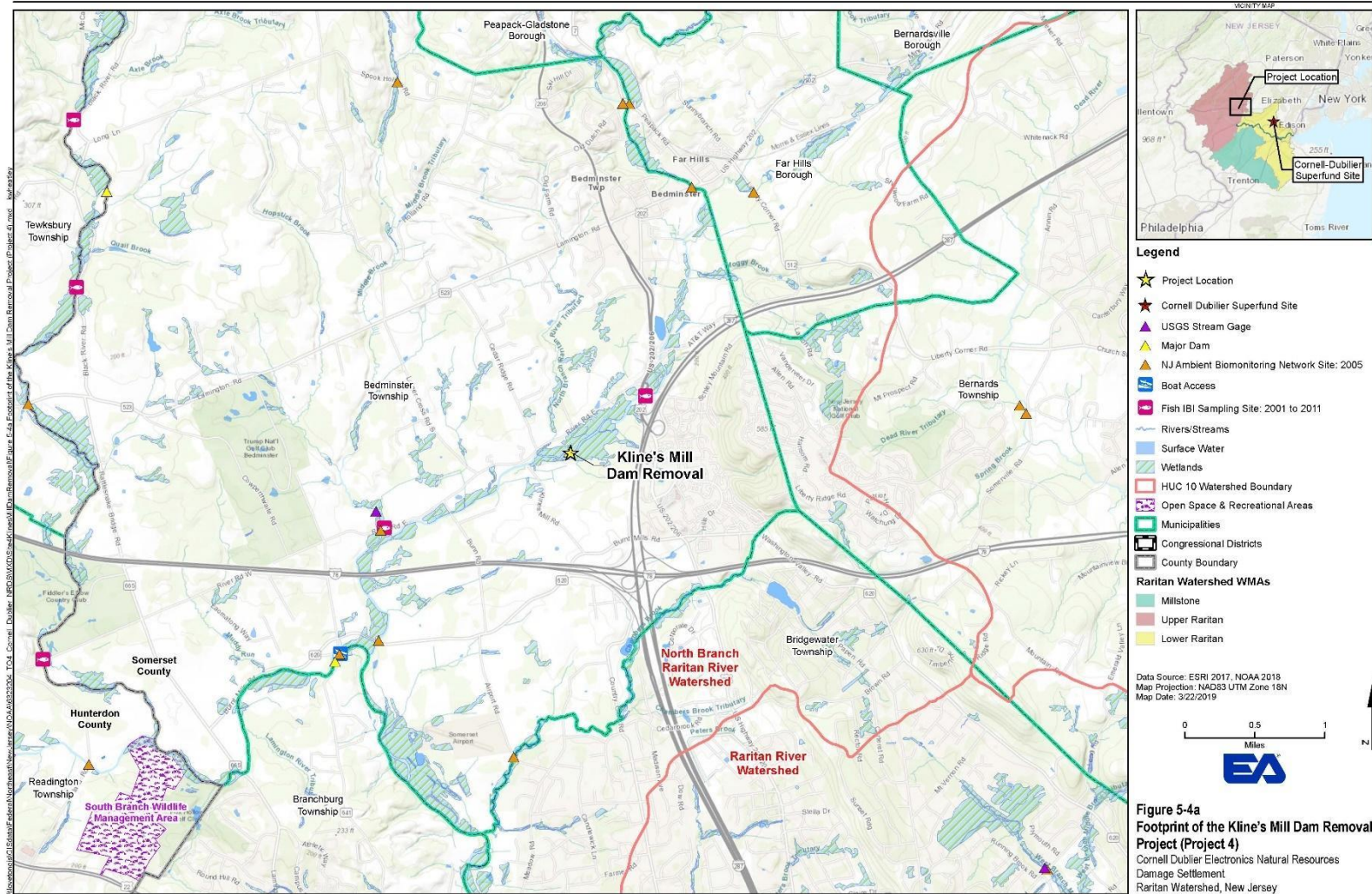
5.4.6 Project Risks and Uncertainties

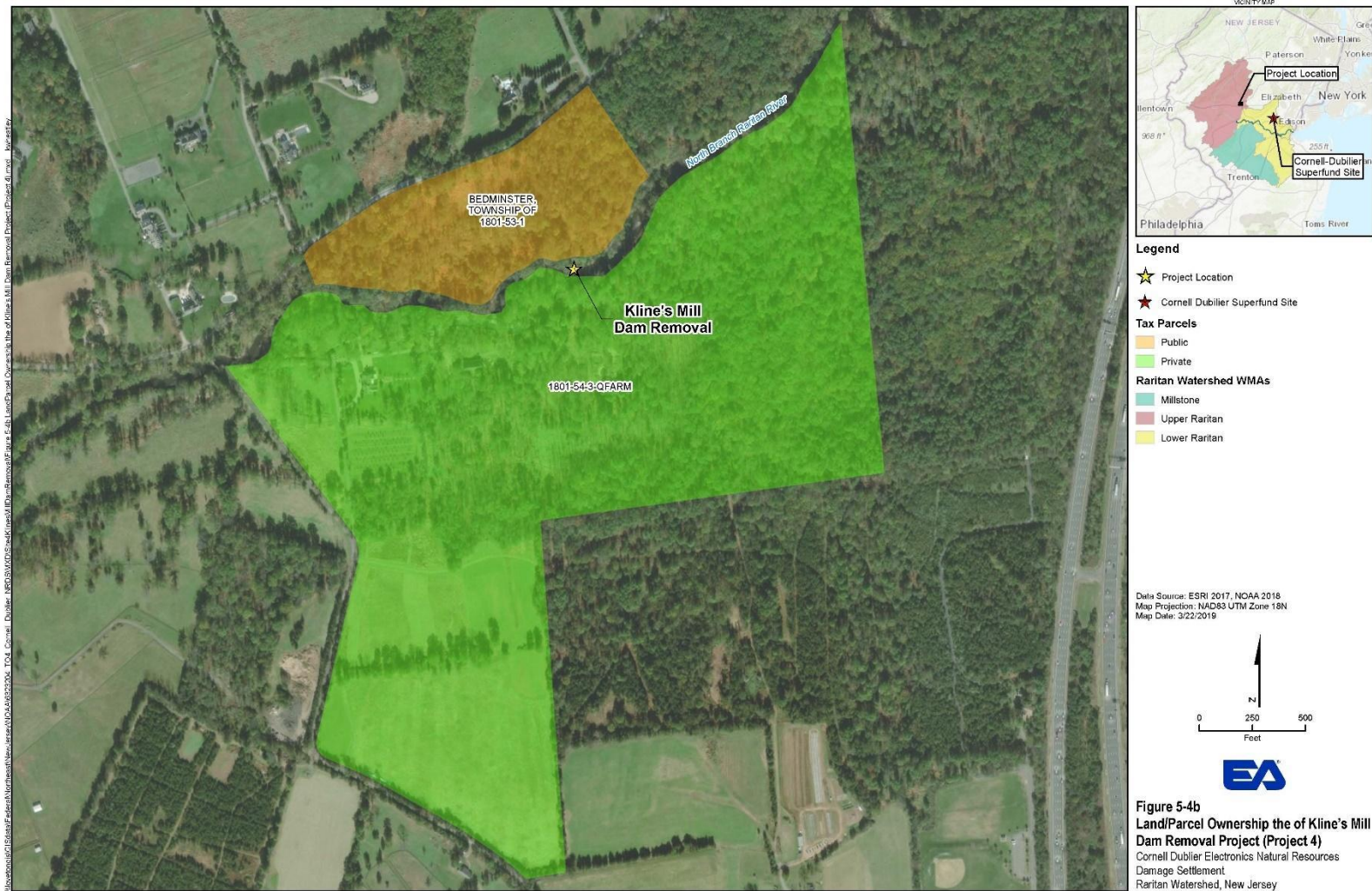
This project has potential risks/infeasibilities regarding cultural concerns and cost to complete. Not enough information is currently available to determine if site access issues would exist. The project site is partially privately owned and, therefore, any actions would need to be approved by the landowner. There is evidence that the site may be in the vicinity of historical structures, including the privately owned and reconstructed mill building with the original mill drive intact. This structure is listed on the National and New Jersey Register of Historic Places. The cost of this project is unknown, but expected to be less than \$1 million.

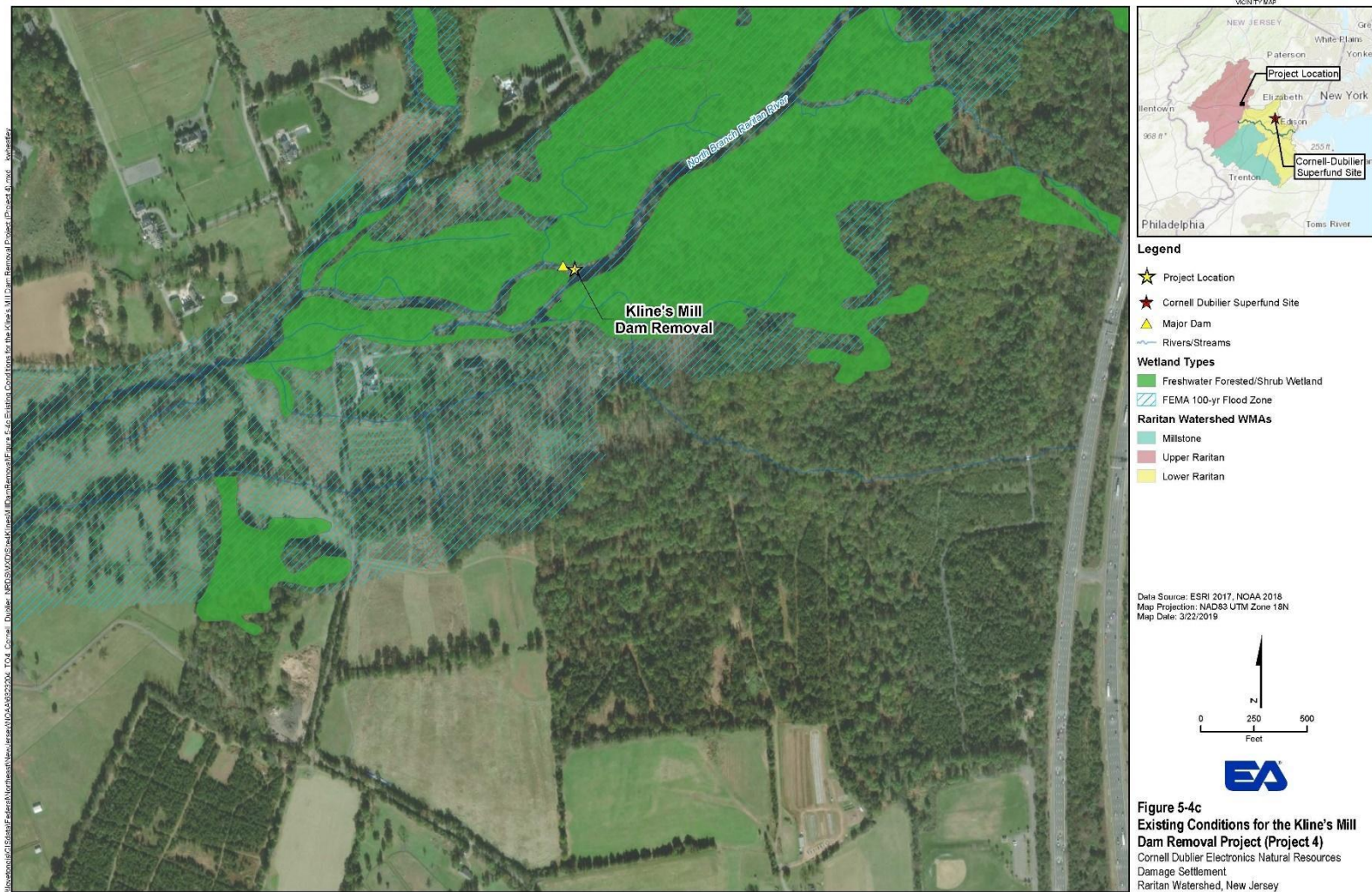
5.4.7 Resource Materials

Resources used in addition to those described in Section 5.1 include:

USGS. National Water Information System. Accessed March 2019.







5.5 CALIFON DAM REMOVAL (PROJECT 5)

5.5.1 Project Stakeholder(s)

The Califon Dam Removal project was proposed by USFWS and may be implemented in partnership with the Raritan Headwaters Association. There has been no action to date on this project. The dam and associated millpond are both privately owned and, therefore, landowner buy-in would need to be obtained prior to implementation.

5.5.2 Project Location and Background

The Califon Dam Removal (Project 5) is a proposed project located on the South Branch Raritan River, in Hunterdon County, New Jersey (Figure 5-5a). The Califon Dam is located within the Califon Historic District, which encompasses approximately 150 dwellings, commercial buildings, and secondary structures. Most of these structures date to the mid-19th to early-20th century. Approximately 500 ft. downstream of the dam is a New Jersey Ambient Biomonitoring Network site. The project site is in the South Branch Raritan River watershed, within the Upper Raritan Watershed Management Area.

The dam is approximately 130 ft. long, gravel/concrete, run-of-river, and impounds approximately 5.3 acres of the South Branch Raritan. There is some evidence that the dam was constructed in the mid-1800s. The impoundment has poor water quality and causes thermal impacts downstream at the Ken Lockwood Gorge. The dam also causes frequent flooding on the adjacent River Road. Approximately 30 ft. of the Califon Dam was damaged by ice in January 2018. The damage caused the water level in the impoundment to drop 8-10 inches over a 24-hour period. Due to this incident the NJDEP Bureau of Dam Safety notified the dam owner in writing that the dam must be repaired or removed.

5.5.3 Proposed Restoration Action

The proposed action is a **dam removal** project to **enhance** cold-water stream habitat. Specific project components would include:

- General reconnaissance of the dam structure;
- Coordination with private land owner; and
- Dam removal.

5.5.4 Site Conditions

The Califon Dam is located on private property owned by a single property owner (Figure 5-5b). There is a 5.3-acre pond impounded upstream of the dam and a tract of freshwater wetland immediately downstream of the dam (Figure 5-5c). The project site and private parcel are located within the 100-year floodplain.

While no specific target species were identified by the stakeholder, implementation of this project would have benefits to water quality and cold-water habitat in this portion of the South Branch Raritan River. Several species of freshwater fish (e.g., salmonids) are dependent on cold-water habitat. The dam itself impounds a small millpond, which has very poor water quality. Therefore, dam removal would benefit numerous aquatic species, such as freshwater mussels.

Table 5-5a Target Species for the Califon Dam Removal Project

Species Name	Type	Federal/State Listed Status
Brook Trout (<i>Salvelinus fontinalis</i>)	Fish	Not listed
Rainbow Trout (<i>Oncorhynchus mykiss</i>)	Fish	Not listed
Brown Trout (<i>Salmo trutta</i>)	Fish	Not Listed

5.5.5 Natural Resource and Human Use Benefits

Implementation of the Califon Dam Removal project would result in opening approximately 17 miles of enhanced cold-water stream habitat for fish, as measured from the nearest downstream impoundment to the headwaters of the South Branch Raritan River (Table 5-5b).

Table 5-5b Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Instream Habitat	17 miles	Improved water quality, improved cold-water habitat

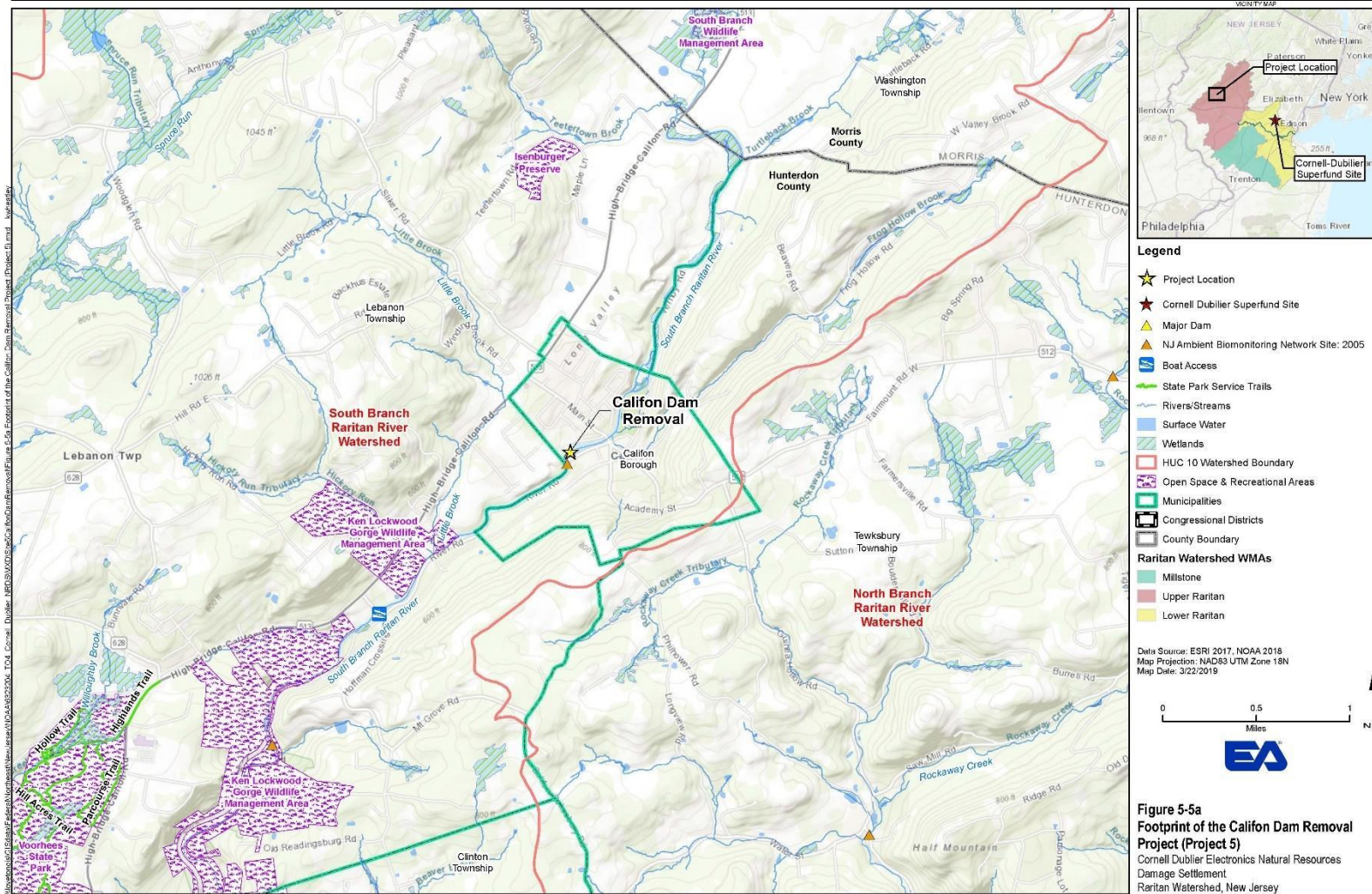
The Califon Dam will help to improve water quality in the upper reaches of the South Branch Raritan River. Due to its upstream location, it is unlikely that dam removal will benefit diadromous fish. However, cold-water-dependent fish species, including salmonids, would benefit through benefits to habitat and water quality. The current small millpond impounded by the dam has very poor water quality, and removal of this impoundment would benefit sensitive aquatic species, including freshwater mussels.

5.5.6 Project Risks and Uncertainties

This project has potential risks/infeasibilities regarding cultural concerns and cost to complete. Not enough information is currently available to determine if site access issues would exist. The dam and associated millpond are privately owned, and it is possible that dam removal would alter tax bills. For this project to be feasible, approval would have to be obtained from the landowner. It is possible that the millpond may have social or cultural significance to the Califon municipality, so this aspect would need to be further examined. The cost of this project is unknown, but unlikely to exceed \$1 million.

5.5.7 Resource Materials

No additional resource materials were available for this project.







5.6 COUNTY BOAT LAUNCH AT LINCOLN AVENUE PARK (PROJECT 6)

5.6.1 Project Stakeholder(s)

The County Boat Launch at Lincoln Avenue Park project was proposed by USFWS and may be implemented in partnership with the Borough of Manville and Somerset County, New Jersey. There has been no action to date on this project.

5.6.2 Project Location and Background

The County Boat Launch at Lincoln Avenue Park (Project 6) is a proposed project to provide recreational access for fishing and boating on the Millstone River. This will be accomplished through improvements to a small motorized craft boat launch at the southwest corner of Lincoln Avenue Park, located in Manville, Somerset County, New Jersey (Figure 5-6a). The boat launch is located on the Millstone River, just downstream of the confluence with Royce Brook Tributary and just below the former Weston Mill Dam, which was removed in 2017. There is a New Jersey Ambient Biomonitoring Network site located at the boat launch, and another New Jersey Ambient Biomonitoring Network site paired with a Fish IBI sampling site approximately a half mile upstream of the boat launch on the Royce Brook tributary. The Delaware Raritan Canal State Park and Main Canal Trail are located near the boat launch, making this a prime area for recreation.

The boat launch is composed of hard-packed gravel to the water line, then is gravel/riprap into the river. New riprap and gravel were added to the launch in fall 2017, as part of the Weston Mill Dam removal. However, the new riprap and gravel as well as potential re-shaping of underlying substrates has caused the launch to be too shallow for motorized craft launch during low to moderate flows.

5.6.3 Proposed Recreational Use Action

The proposed action is a **recreational** use project to **enhance** public access. The launch site is frequently used for launching both motorized and non-motorized watercraft, as well as for fishing. To provide additional recreational access on the Millstone River at the county boat launch, the stakeholder proposes:

- Removal of the existing riprap within the instream base of the boat launch;
- Re-surfacing the launch with riprap and gravel so that it is accessible to boats during low to moderate flows; and
- Installing an ADA-accessible fishing structure.

5.6.4 Site Conditions

The boat launch is located on public land owned by the County of Somerset (Figure 5-6b), and both the boat launch and Lincoln Park are owned and maintained by the County. Although there are no wetlands at the project site, there are both freshwater emergent and freshwater forested/shrub wetlands within 1,000 ft. (Figure 5-6c). A tract of the Delaware and Raritan Canal State Park is located immediately downstream of the boat launch. The project site is located within the 100-year floodplain and is known to be prone to flooding during heavy rain events.

5.6.5 Natural Resource and Human Use Benefits

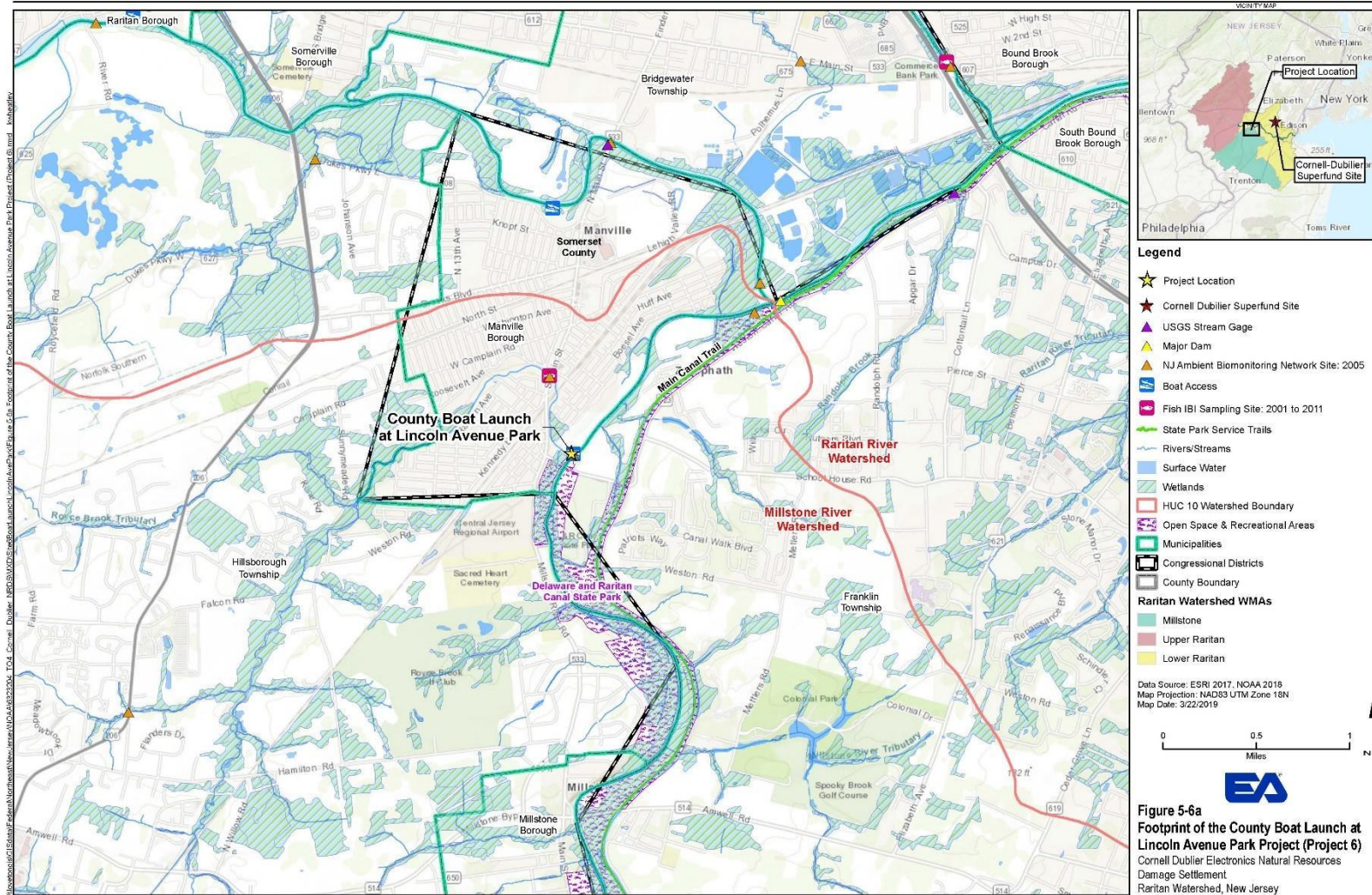
It is currently infeasible to estimate the number of human recreation acres created as a result of this project. However, this launch site is frequently used for both motorized and non-motorized watercraft, so improvements would likely increase the number of users accessing the Millstone River. In particular, small Jon boats and other motorized boats would be able to more easily access the river during low flow conditions. The proposed ADA-accessible fishing structure would allow users to reach deep water near the Weston Mill Dam.

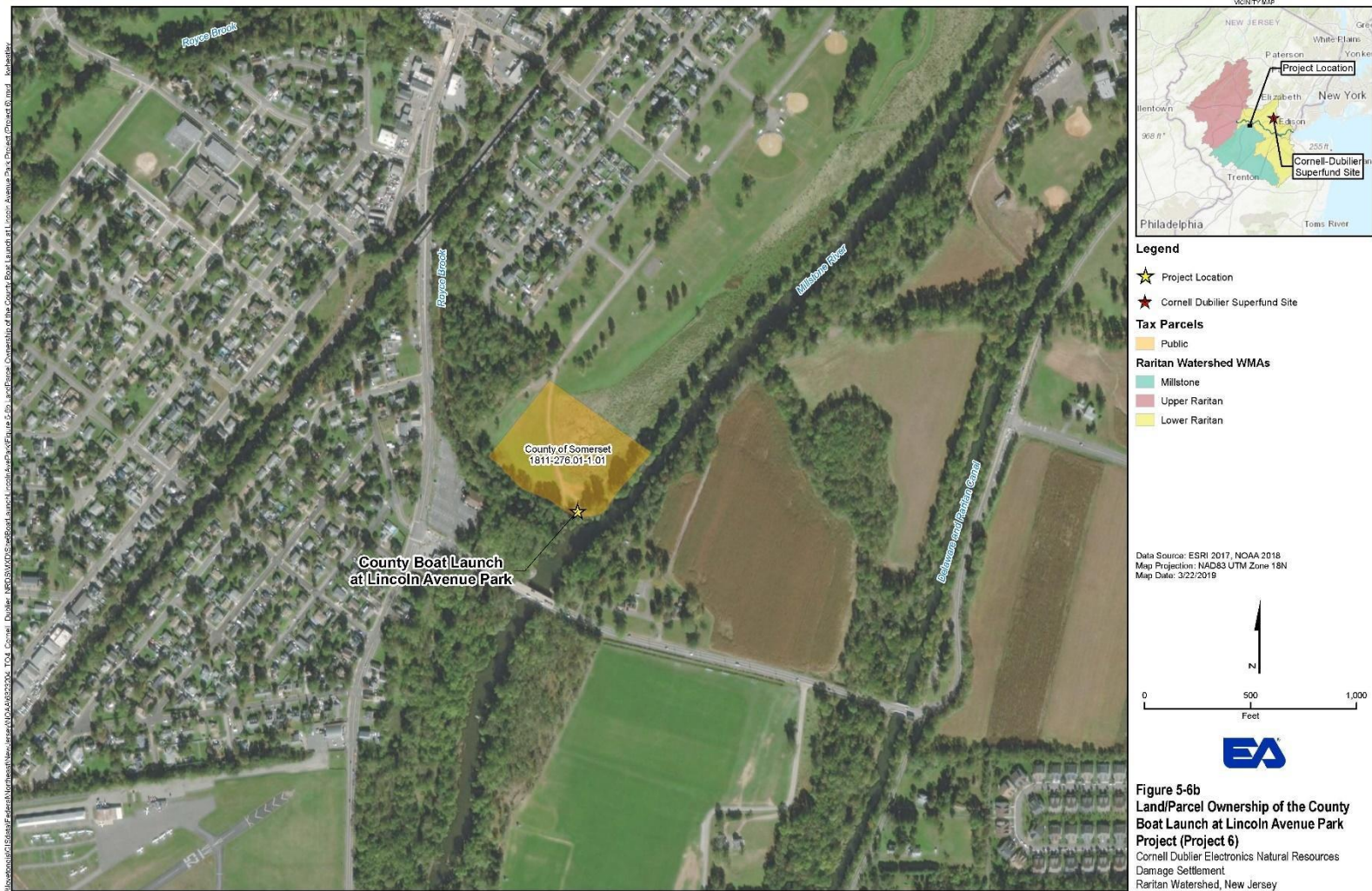
5.6.6 Project Risks and Uncertainties

This project has potential risks/infeasibilities regarding site control and engineering design, although overall, improvements to the county boat launch are likely to be relatively simple and inexpensive. However, the stakeholder did not provide a cost estimate, nor did they state if any funds were available for this project. Feasibility of installing an ADA fishing structure is unknown, and would need to be assessed. The project is in an area prone to flooding during heavy rain events, which will need to be taken into consideration in the design of a fishing structure and the maintenance associated with the boat launch. In addition, it is important that the fishing pier does not interfere with the Royce Brook tributary, which enters just upstream of the existing boat launch.

5.6.7 Resource Materials

No additional resource materials were available for this project.







5.7 CHERRY BROOK PRESERVE RESTORATION – CONSTRUCTED WETLAND (PROJECT 7)

5.7.1 Project Stakeholder(s)

The Cherry Brook Preserve Restoration Constructed Wetland project was proposed by Montgomery County, New Jersey. The County conducted a preliminary investigation in 2012 to determine the best way to restore a pond on Montgomery Township open space property (Kleinfelder 2012). The town elected to create a constructed wetland. Funding constraints have prevented the township from initiating the project, and the site was not selected for National Park Service grant funds requested in 2017.

5.7.2 Project Location and Background

The Cherry Brook Preserve Restoration Constructed Wetland (Project 7) is a proposed constructed wetland where the man-made Cherry Brook Pond currently exists. Historic aerial imagery analysis shows that the pond was constructed in the 1940s, likely as a farm pond. The pond is located in the 400+-acre Cherry Brook Preserve off of Cherry Hill Road in Montgomery County. The pond is located on Cherry Run tributary, just west of the Princeton Airport. This tributary flow west to Cherry Run which continues north to Beden Brook and eventually meets the Millstone River. The Millstone River watershed is one of the three major river basins in the Raritan River watershed. Downstream of the project site there is one Fish IBI sampling site and one New Jersey Ambient Biomonitoring Network site before Beden Brook meets the Millstone River (Figure 5-7a).

The ¾-acre Cherry Brook Pond drains residential, agricultural, and forested land totaling approximately 150 acres. High turbidity and algal blooms cause the pond to be aesthetically poor, and a buildup of sediment has resulted in a summer water depth of less than 1 ft. with patches of exposed sediment throughout. Bathymetric surveys confirm that the pond contains approximately 780 cubic yards of unconsolidated sediment. The presence of large areas of exposed sediment has made the pond an ongoing source of sediment and phosphorus to downstream reaches. In addition, the pond embankment retaining walls and outlet are not functional.

5.7.3 Proposed Restoration Action

The proposed action is a **wetland** project to **restore** a man-made pond in the Cherry Run tributary to a constructed wetland. Specific project components would include:

- Dredging of accumulated sediment and silt;
- Re-grading of existing pond area to create various ecological wetland zones with deep pool, high marsh, and low marsh areas, planted only with native species;

- Construction of site amenities to integrate the project with open space access trails, to enhance public education and enjoyment; and
- Monitor pre- and post- construction for effectiveness of reducing total phosphorus and total suspended solids.

5.7.4 Site Conditions

The project site is located on Montgomery Township open space property (Figure 5-7b). The existing pond is about $\frac{3}{4}$ acres of shallow water with exposed sediment. The upstream and downstream reaches surrounding the pond are classified as freshwater forested/ shrub wetland. Princeton Airport is located about $\frac{1}{2}$ mile to the east, and farmland surrounds the site to the north and northeast. Residential areas lie to the northwest and southwest, while forested areas surround the rest of the site (Figure 5-7c).

Implementation of this project would create a variety of new habitats, increasing ecological diversity. Planting with native plants and creating deep pool, high marsh, and low marsh areas will contribute to the improved habitat. Protected species and species of concern potentially found in the area include the Wood Turtle (*Glyptemys insculpta*), Bobcat (*Lynx rufus*), and Great Blue Heron (*Ardea herodias*) as presented in Table 5-7a.

Table 5-7a Target Species for the Cherry Brook Preserve Restoration Constructed Wetland Project

Species Name	Type	Federal/State Listed Status
Wood Turtle (<i>Glyptemys insculpta</i>)	Reptile	Threatened – State
Bobcat (<i>Lynx rufus</i>)	Mammal	Endangered – State
Great Blue Heron (<i>Ardea herodias</i>)	Bird	Species of Concern

5.7.5 Natural Resource and Human Use Benefits

Implementation of the Cherry Brook Preserve Restoration Constructed Wetland project would result in the enhancement of 0.3 acre of stream miles and 1 acre of wetland habitat. In addition, 1 acre of recreation area would be created (Table 5-7c). This would create a more ecologically diverse and aesthetically pleasing environment and help to reduce phosphorus and excess sediment moving downstream. The ecological diversity would provide habitat to a variety of wildlife species.

Table 5-7c Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Stream	0.3 mile	Improved stream connectivity, improved habitat
Wetland	1 acre	Reduced pollutant and sediment loads, improved habitat, improved aesthetic value

The newly constructed wetland area would be an optimum place to connect to existing trail systems, increasing recreational and educational land access. The community would also benefit

from this project, as constructed wetlands are known to have high pollutant removal efficiencies due to natural water treatment processes such as plant uptake, bioremediation, and sedimentation. The New Jersey Stormwater Management Best Management Practices Manual allocates higher sediment and nutrient removal efficiencies for constructed wetlands as compared to ponds.

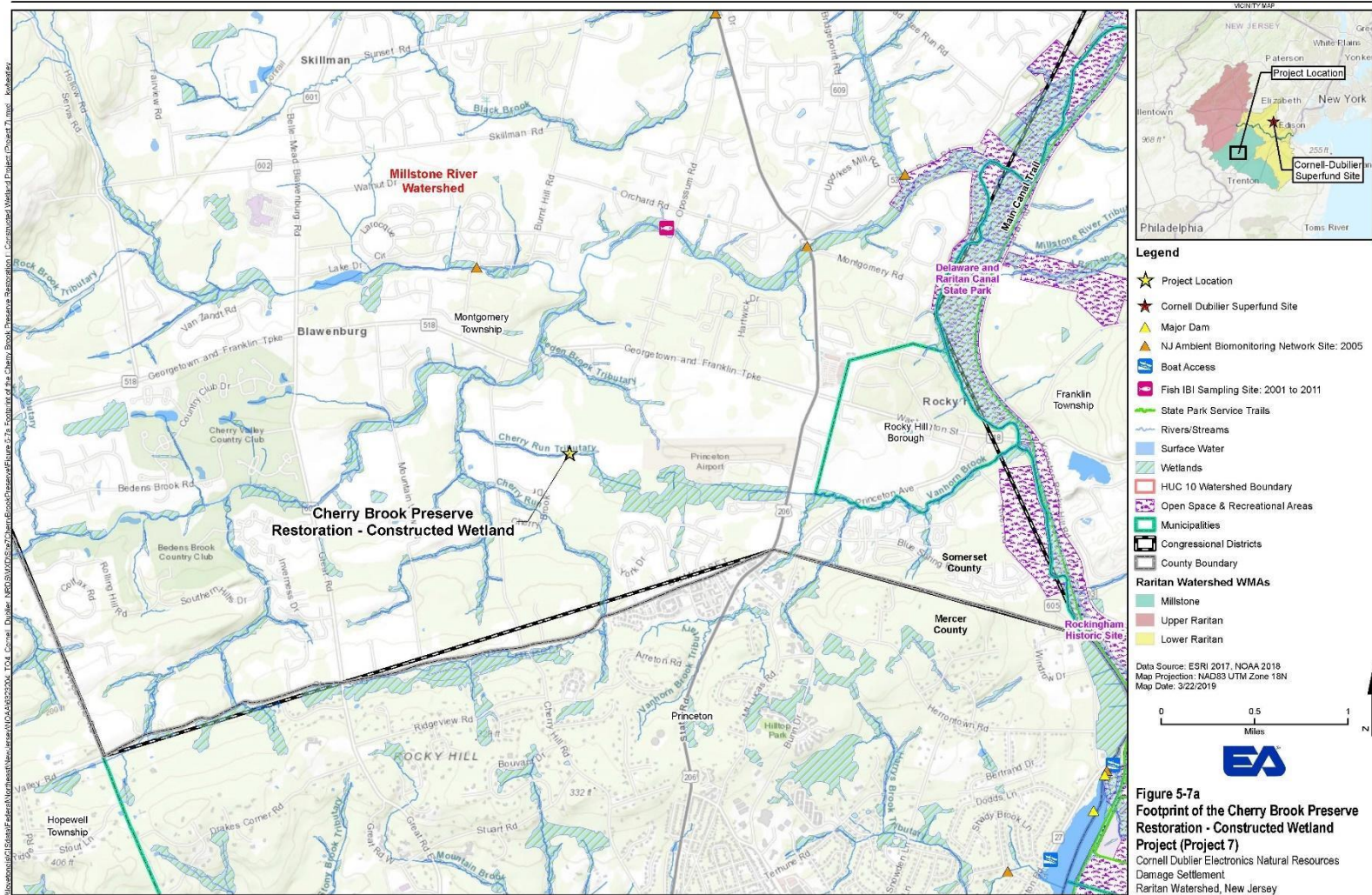
5.7.6 Project Risks and Uncertainties

This project has potential risks/infeasibilities regarding engineering design and regulatory processes. Potential uncertainties involve regulatory procedures as up to five individual permits may be required. It is also expected that there will be technical uncertainties in the project's ability to provide hydrological conditions necessary for freshwater wetlands and unknown water quality issues from runoff. Regarding project costs, the stakeholder stated they have \$175,000 in available funds, and they estimate the project would cost approximately \$735,000 to complete.

5.7.7 Resource Materials

Resources used in addition to those described in Section 5.1 include:

2017 Water Quality Restoration Grants: Application for Funding and Cherry Brook Pond Restoration Project: Preliminary Design Report (2012).







5.8 RARITAN BAY OYSTER RESTORATION (PROJECT 8)

5.8.1 Project Stakeholder(s)

The Raritan Bay Oyster Restoration project was proposed by the New York-New Jersey Harbor Estuary Program. There has been no action on this project to date.

5.8.2 Project Location and Background

The Raritan Bay Oyster Restoration Project (Project 8) could be implemented within many suitable areas in Raritan Bay (Figure 5-8). Raritan Bay is located between New York and New Jersey; the shoreline of the bay contains several park/recreation areas and tributaries where New Jersey Ambient Biomonitoring Network sites are located (Figure 5-8).

Human development during the past century had negatively impacted the many ecosystems within the project area. With the passage of environmental laws, water quality within the New York-New Jersey Harbor has greatly improved and it is now possible that many aquatic species that have suffered declines in the past could be restored to near historic numbers in areas of historic presence (Rutgers 2013). Re-introduction of the Eastern Oyster (*Crassostrea virginica*), could potentially support further improvements in water quality, contribute to stabilization of coastal shorelines, and accelerate ecosystem level restoration processes. Oyster reef creation is a technique to support continued water quality improvement and to reestablish habitat utilized by other aquatic species, as well as serve as a natural method to reduce shoreline erosion (Rutgers 2013).

5.8.3 Proposed Restoration Action

Large-scale oyster reef establishment is an important contributor toward achieving the long-term restoration of Raritan Bay. The proposed action is an **oyster restoration** project to **restore** and **enhance** habitat and water quality within Raritan Bay. The restoration/establishment techniques used would be dependent upon the specific area of implementation within the Raritan Bay.

5.8.4 Site Conditions and Natural Resource and Human Use Benefits

This project would focus on the restoration of the Eastern Oyster (Table 5-8a). An online review using the USFWS IPaC project review tool identified one plant and three birds listed as state or federally threatened or endangered species as being potentially present within the project site that would also directly benefit from improved water quality (Table 5-8b). No USFWS critical habitats are present within the project area.

Table 5-8a Target Species for the Raritan Bay Oyster Restoration Project

Species Name	Type	Federal/State Listed Status
Eastern Oyster (<i>Crassostrea virginica</i>)	Mollusk	Not listed

Table 5-8b Listed Status Species Potentially Present at the Raritan Bay Oyster Restoration Project

Species Name	Type	Federal/State Listed Status
Seabeach Amaranth (<i>Amaranthus pumilus</i>)	Flowering Plant	Threatened – Federal
Piping Plover (<i>Charadrius melodus</i>)	Bird	Threatened – Federal
Red Knot (<i>Calidris canutus rufa</i>)	Bird	Threatened – Federal
Roseate Tern (<i>Sterna dougallii dougallii</i>)	Bird	Endangered – Federal

The listed status species are present in the general shoreline areas of Raritan Bay; they utilize shoreline habitat for feeding or nesting, upland habitats, and wetland areas adjacent to the bay.

There would be many ecological and human use benefits from restoring oysters within Raritan Bay. Oyster beds are an important component of the ecosystem, as they provide structurally complex habitat for aquatic organisms at many trophic levels. Oysters also clean the surrounding waters (and can filter silt/excess nutrients from up to 50 gallons of water per day), contributing to both water column and benthic productivity (NOAA Fisheries 2019). Reef restoration also directly benefits waterfront communities by providing storm surge protection for waterfront structures and also serves to protect and fortify existing wetlands, which improves their function as protective barriers to storm surge as well.

5.8.5 Project Risks and Uncertainties

The cost of this project is unknown and is dependent on the scale of implementation. NJDEP currently maintains a ban on live reef restoration in waters classified as Prohibited, which will likely create permitting challenges. Environmental condition indexing and site survival and growth rate testing are not up to date for the proposed project area and would need to be performed prior to site selection. Oyster predation, disease, persistent contamination, and poor performance of biological indicators such as growth, cavity size, and reproductive maturity have been reported to affect reef performance at restoration sites across the New York and New Jersey Harbor Estuary.

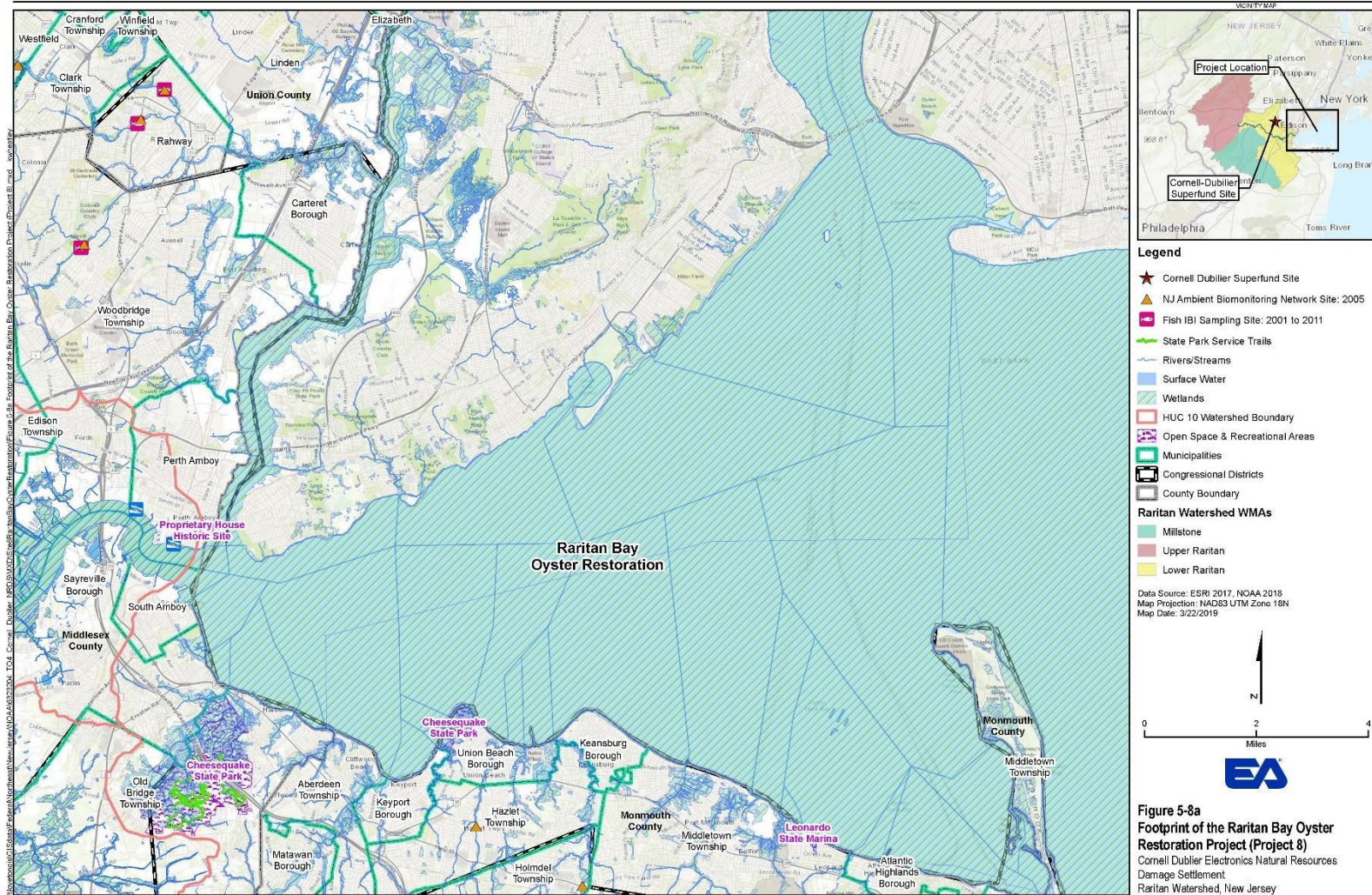
5.8.6 Resource Materials

Resources used in addition to those described in Section 5.1 include:

NOAA Fisheries. 2019. *Eastern Oyster*. <https://www.fisheries.noaa.gov/species/eastern-oyster>.

Rutgers Center for Urban Environmental Sustainability. 2013. *NY/NJ Baykeeper Oyster Habitat Restoration Feasibility Study. 2011-2012 Raritan Bay Mapping Study: Pre-Superstorm Sandy*. December.

Rutgers Center for Urban Environmental Sustainability. 2013. *NY/NJ Baykeeper Oyster Habitat Restoration Feasibility Study. Final Report (2007-2013) Year 7:2013 Year End Report*. December.



5.9 EAST BRUNSWICK SWAMP PINK RESTORATION (PROJECT 9)

5.9.1 Project Stakeholder(s)

The East Brunswick Swamp Pink Restoration project was proposed by USFWS. The stakeholder has not received any funding for this project and project development has not begun. The project proponent intends to reach out to East Brunswick Township (landowner) in the upcoming months to set up a Partners for Fish and Wildlife Agreement for this project. A Partners for Fish and Wildlife Agreement outlines the project activities USFWS is looking to pursue on the property, outlines estimated costs, etc.

5.9.2 Project Location and Background

The East Brunswick Swamp Pink Restoration Project (Project 9) is a proposed invasive species control restoration project located in the Lower Raritan River watershed in East Brunswick, New Jersey. For the purpose of this report, the exact location of the population will not be disclosed.

Swamp pink (*Helonias bullata*) is a wetland obligate plant listed as federally threatened. Only two populations of swamp pink remain within the Raritan River watershed. The East Brunswick swamp pink population is comprised of 13 individual plants (recorded in November 2018) that are negatively impacted by deer browse at the project site. Only a small number of swamp pink plants flower each spring and their flower heads are preferentially consumed by deer.

Implementation of this project would also restore the forested wetland community that hosts the swamp pink plant. The Atlantic white cedar (*Chamaecyparis thyoides*) is experiencing a decline in cover, resulting from fires and forestry activity. Recently germinated cedar seedlings are present in the understory, but their growth is likely being suppressed by the high level of deer browse at the site. Because of the lack in adequate canopy cover, the invasive plant Japanese stilt grass (*Microstegium vimineum*) is becoming dominant at the project site.

5.9.3 Proposed Restoration Action

The swamp pink population within the project site represents the northernmost range of the species and the health of this population is important for maintaining the distribution and genetic diversity of the species.

The proposed action is an **invasive species control** project to **protect** the East Brunswick swamp pink population and the existing canopy cover at the site. Specific project components would include:

- Construction of a 6- to 8-ft-high metal deer fence around seven of the swamp pink plants;
- Installation of hand-built anti-herbivory cages around the seven plants within the fence in the case of fence failure;

- Installation of hand-built anti-herbivory cages over remaining swamp pink plants located outside of the deer fence; and
- Addition of 250 Atlantic white cedar saplings with tree tubes to discourage browse of seedlings and allow for canopy regeneration.

5.9.4 Site Conditions

The land within the project site is comprised parcels owned by East Brunswick Township.

The existing wetland habitat within the project site contains forested scrub/shrub and is situated within a larger tract of forested scrub/shrub wetland, and freshwater emergent wetland areas are present near the site. Almost all of the site is located within the 100-year floodplain.

Implementation of this project would benefit swamp pink within the forested wetland and wildlife that utilize the project area. Specific target species identified by the project proponent are presented in Table 5-9a. In addition, an online review using the USFWS IPaC project review tool identified one mammal listed as state or federally threatened or endangered species, or Species of Special Concern as being potentially present within the project site (Table 5-9b). No USFWS critical habitats are present within the project area.

Table 5-9a Target Species for the East Brunswick Swamp Pink Restoration Project

Species Name	Type	Federal/State Listed Status
Swamp pink (<i>Helonias bullata</i>)	Flowering Plant	Threatened- Federal
Atlantic white cedar (<i>Chamaecyparis thyoides</i>)	Plant	Not listed

Table 5-9b Listed Status Species Potentially Present at the East Brunswick Swamp Pink Restoration Project Site

Species Name	Type	Federal/State Listed Status
Northern Long-Eared Bat (<i>Myotis septentrionalis</i>)	Mammal	Threatened – Federal

5.9.5 Natural Resource and Human Use Benefits

Implementation of the East Brunswick Swamp Pink Restoration would result in the protection approximately 0.03 acre of restored wetland habitat (Table 5-9c).

Table 5-9c Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Forested scrub/shrub wetland	Approximately 0.03 acre	Invasive species removal, threatened species protection, restoration of canopy cover, improved ecosystem function

Approximately 0.025 acre of Atlantic white cedar forested wetland (swamp pink habitat) would be enhanced with Atlantic white cedar seedlings to encourage regeneration and improve stand conditions. Another 0.05 acre of forested wetland habitat would additionally be enhanced by

eliminating herbivore pressure that is adversely impacting the vegetation composition and structure. Though small, this habitat is important as Atlantic white cedar is a relatively rare forest type in this area of New Jersey and it hosts one of the northernmost populations of federally threatened swamp pink.

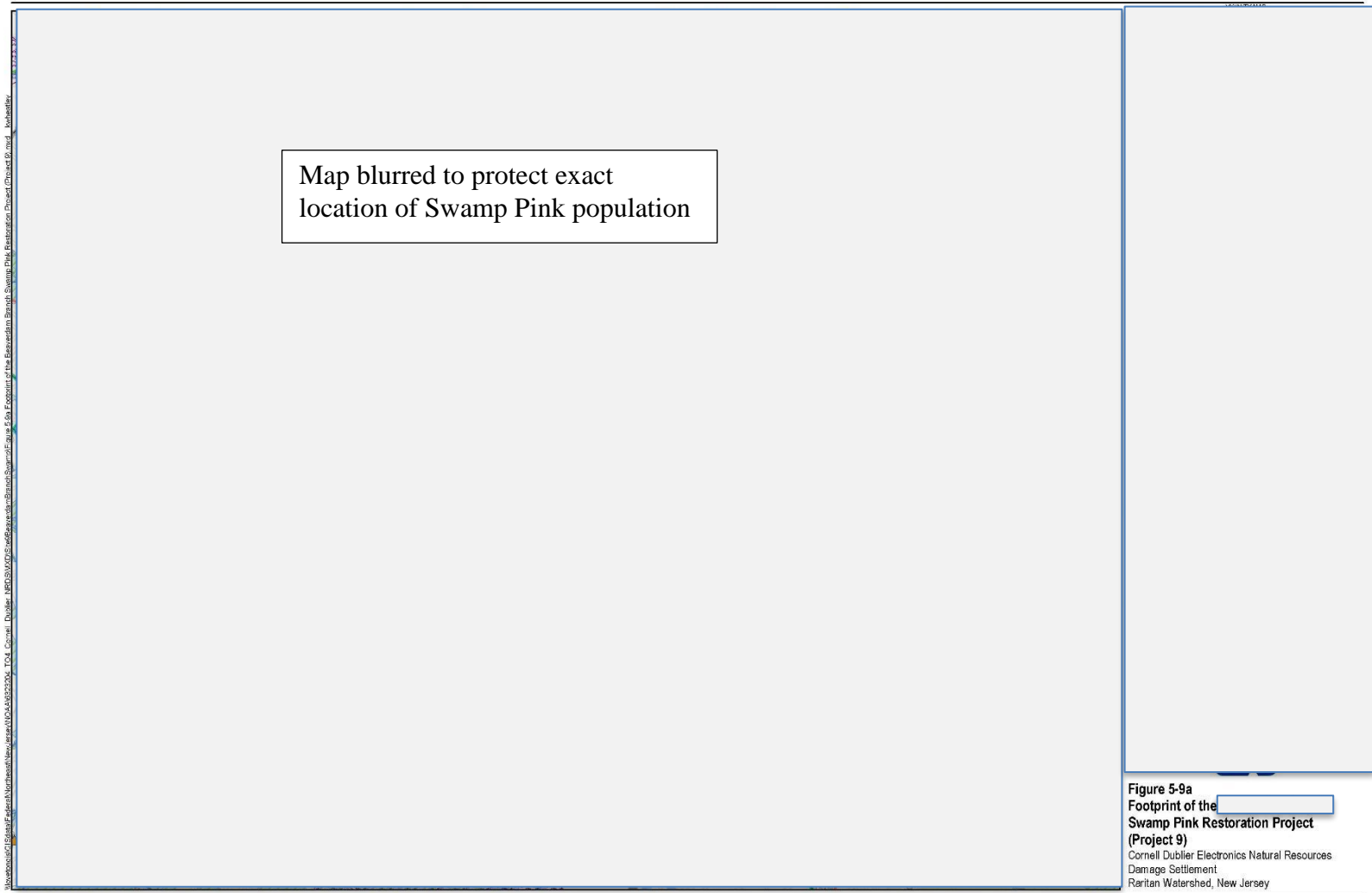
This project will protect the existing swamp pink population and will improve the quality and function of the forested wetland through restoration of the forest canopy and removal of invasive plant species. The native Atlantic white cedar generally forms a canopy too dense to allow invasive species to persist; newly planted trees would act as a buffer to discourage the invasive Japanese stilt grass or any other invasive plants from colonizing the area occupied by the swamp pink. An overall improved habitat will benefit wildlife species that may use the site for nesting, foraging, or migratory stop-over. In addition to natural resource benefits, this project would result in an improved visual aesthetic of the area from a restored forest canopy with a natural appearance. This would also potentially benefit recreational use within the project area.

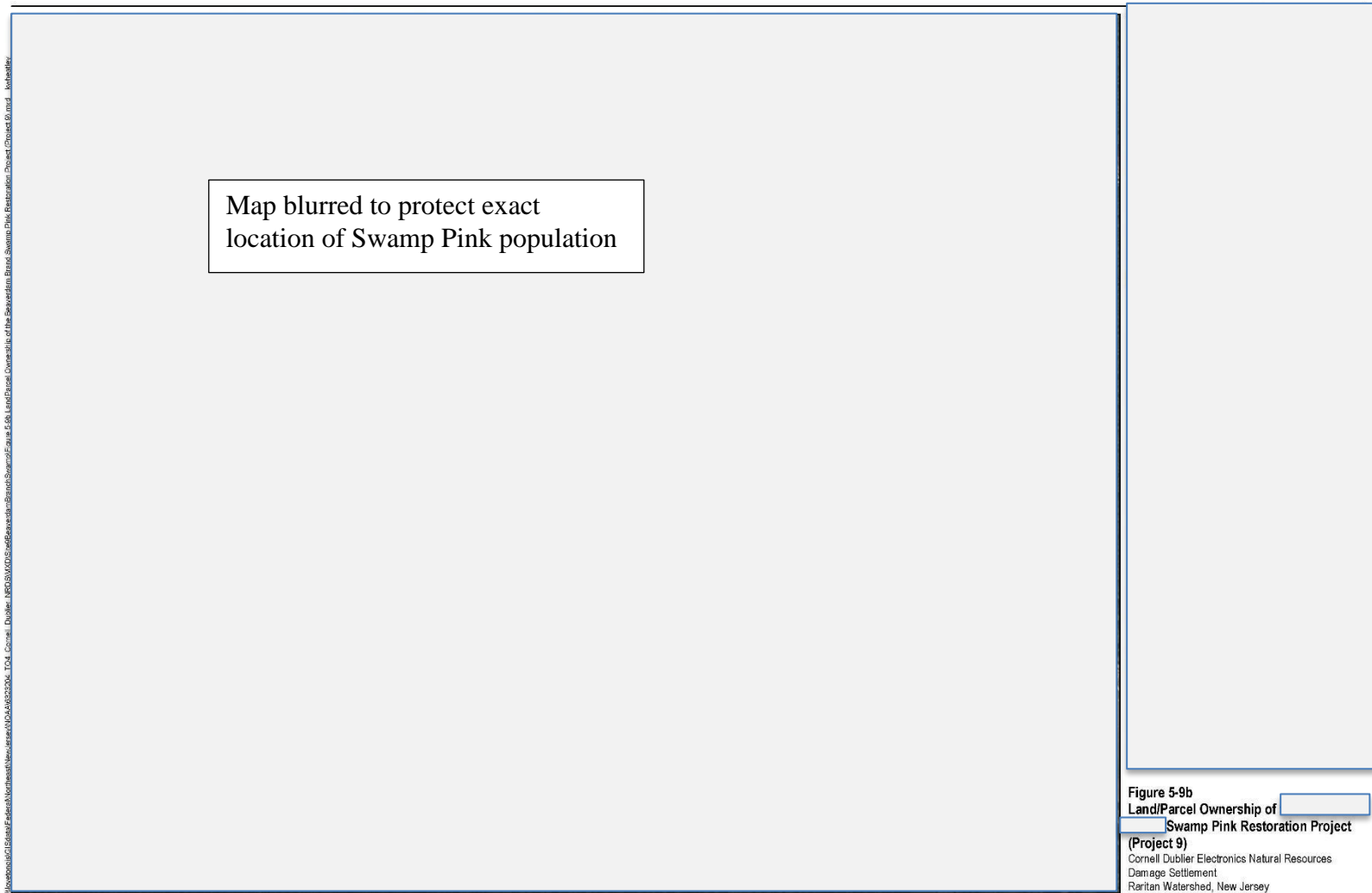
5.9.6 Project Risks and Uncertainties

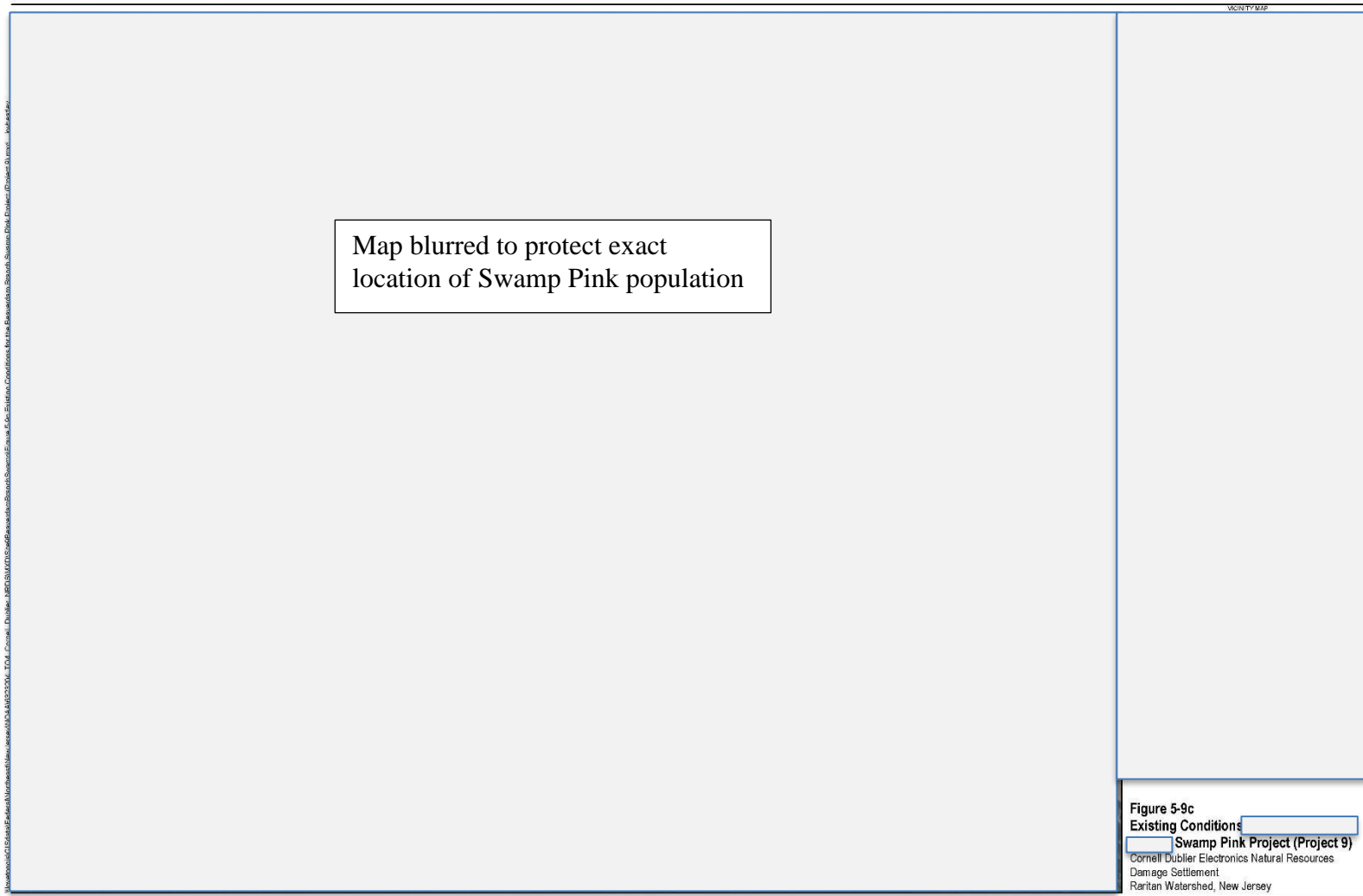
The only identified risk for this project is the possibility of the swamp pink being out competed within the deer fence while Atlantic white cedar become established. Additionally, East Brunswick Township owns the property and the Town Board and administrator would need to vote on signing the Partners for Fish and Wildlife Agreement, which would allow the work to be performed. Once the agreement is signed, no constraints regarding site control/access are anticipated. The stakeholder stated that they have \$500 in available funds for this project and that it will take approximately \$10,000 to complete.

5.9.7 Resource Materials

No additional resource materials were available for this project.







5.10 RUTGERS ECOLOGICAL PRESERVE (PROJECT 10)

5.10.1 Project Stakeholder(s)

The Rutgers Ecological Preserve project was proposed by Rutgers University and may be implemented in partnership with the Sustainable Raritan River Initiative and the Lower Raritan Watershed Partnership. This project is currently in the design phase.

5.10.2 Project Location and Background

The Rutgers Ecological Preserve is located on the New Brunswick campus of Rutgers University, approximately 40 miles southwest of New York City, near the Highland Park Borough. The preserve is located on Buell Brook, a headwater stream that drains to the Raritan River (Figure 5-10a). The project site encompasses 400 acres of woodlands and meadows situated south of CDE within the Lower Raritan River watershed (Figure 5-10a). New Jersey Ambient Biomonitoring Network sites are located approximately 2 miles north and southwest of the project site and approximately 4 miles east of the project site. A Fish IBI sampling site is also located in the same location as the New Jersey Ambient Biomonitoring Network site southwest of the preserve.

The Rutgers Ecological Preserve was formally established by the Rutgers Board of Governors as the Rutgers Ecological Preserve and Natural Teaching Area in 1976. The goal of the Ecological Preserve was to preserve the natural ecological characteristics of the property and to serve as an outdoor teaching area for the university. Today, the Ecological Preserve maintains this balance between preserving and restoring the area's ecological system and natural values while continuing to expand the Ecological Preserve's role as an educational, recreational, and aesthetic resource for University students, faculty and staff, as well as local citizens. The Ecological Preserve currently has approximately 8 miles of multi-use trails for hiking, running, and mountain biking, but no trails are ADA-accessible.

5.10.3 Proposed Action

The proposed action is a **recreation** project to **enhance** access to and enjoyment of the Ecological Preserve for people with disabilities, as well as people with small children. Specific project components include:

- Construction of a 1/3-mile ADA-accessible trail at the Rutgers Ecological Preserve. The proposed trail would loop from the Ecological Preserve parking lot and access the mature forest with close-up views of Buell Brook.
- Modification of an existing trail loop with fine, compacted red shale that would be approximately 3.5 ft. wide with gentle grades for easy passage of wheelchairs and strollers.

- Construction of a level pull-out with a bench would be constructed near Buell Brook. This would allow access to a shallow section of Buell Brook so visitors have the opportunity to explore the stream in a safe manner.
- Development of a series of educational signs by Rutgers University students highlighting the area's natural and cultural history, which would be installed along the trail. The trail would be open to Rutgers University's students, faculty and staff, as well as the broader community.

5.10.4 Site Conditions

The land within the project site is comprised of a private parcel owned by Rutgers University (Figure 5-10b).

The existing wetland habitat within the project site consists of approximately 0.14 acre of freshwater forested and scrub-shrub wetlands (Figure 5-10c). The freshwater wetlands are mostly located along Buell Brook, both west and south of the proposed ADA-accessible trail. Buell Brook cuts through the center of the preserve and drains directly into the Raritan River. Metlars Brook, located on the western portion of the preserve, also drains into the Raritan River. The entirety of the project footprint is sited outside of the 100-year floodplain.

Rutgers Ecological Preserve provides forested habitat within a suburban area. Dominant deciduous trees within the preserve include red oak (*Quercus rubra*), white oak (*Quercus alba*), ash (*Fraxinus* sp.), American beech (*Fagus grandifolia*), and hickory (*Carya* sp.) In addition, large pin oak (*Quercus palustris*), red maple (*Acer rubrum*), and black cherry (*Prunus serotina*) are also present. Eastern red cedar (*Juniperus virginiana*) is also found within abandoned farm fields on the east and west of the site. Spring ephemerals including spring beauty (*Claytonia virginica*), trout lily (*Erythronium americanum*), mayapple (*Podophyllum pendulatum*), skunk cabbage (*Symplocarpus foetidus*), and Jack-in-the-pulpit (*Arisaema triphyllum*) can be found within the forested areas and some species within the forested wetlands. The forested area within the preserve provides habitat to many songbirds such as Yellow-rumped Warbler (*Setophaga coronata*), Black-and-White Warbler (*Mniotilta varia*), Wood Thrush (*Hylocichla mustelina*), Eastern Towhee (*Pipilo erythrophthalmus*), Tree Swallow (*Tachycineta bicolor*), and House Wren (*Troglodytes aedon*). The forest floor is also home to many species of reptiles and amphibians including Eastern Box Turtle (*Terrapene carolina carolina*), Black Rat Snake (*Pantherophis obsoletus*), Common Garter Snake (*Thamnophis sirtalis*) and American Toad (*Anaxyrus americanus*). There is an overpopulation of White-Tailed Deer (*Odocoileus virginianus*) within the Ecological Preserve. In 2002 a deer management program was implemented to reduce the high level of browsing pressure on the native understory vegetation at the site.

Buell Brook and the adjacent forested/shrub wetlands provide habitat to many aquatic species. Fish including Blacknose Dace (*Rhinichthys atratulus*), Creek Chub (*Semotilus atromaculatus*), and the elver stage of American Eel (*Anguilla rostrata*) inhabit quiet pools. Amphibians including the American Bullfrog (*Lithobates catesbeianus*), Northern Two-Lined Salamander

(*Eurycea bislineata*), and the Northern Dusky Salamander (*Desmognathus fuscus*) also inhabit the streams and adjacent riparian areas. Some bird species such as the Green Heron (*Butorides virescens*) and Great Blue Heron (*Ardea herodias*) also rely on Buell Brook for foraging.

5.10.5 Natural Resource and Human Use Benefits

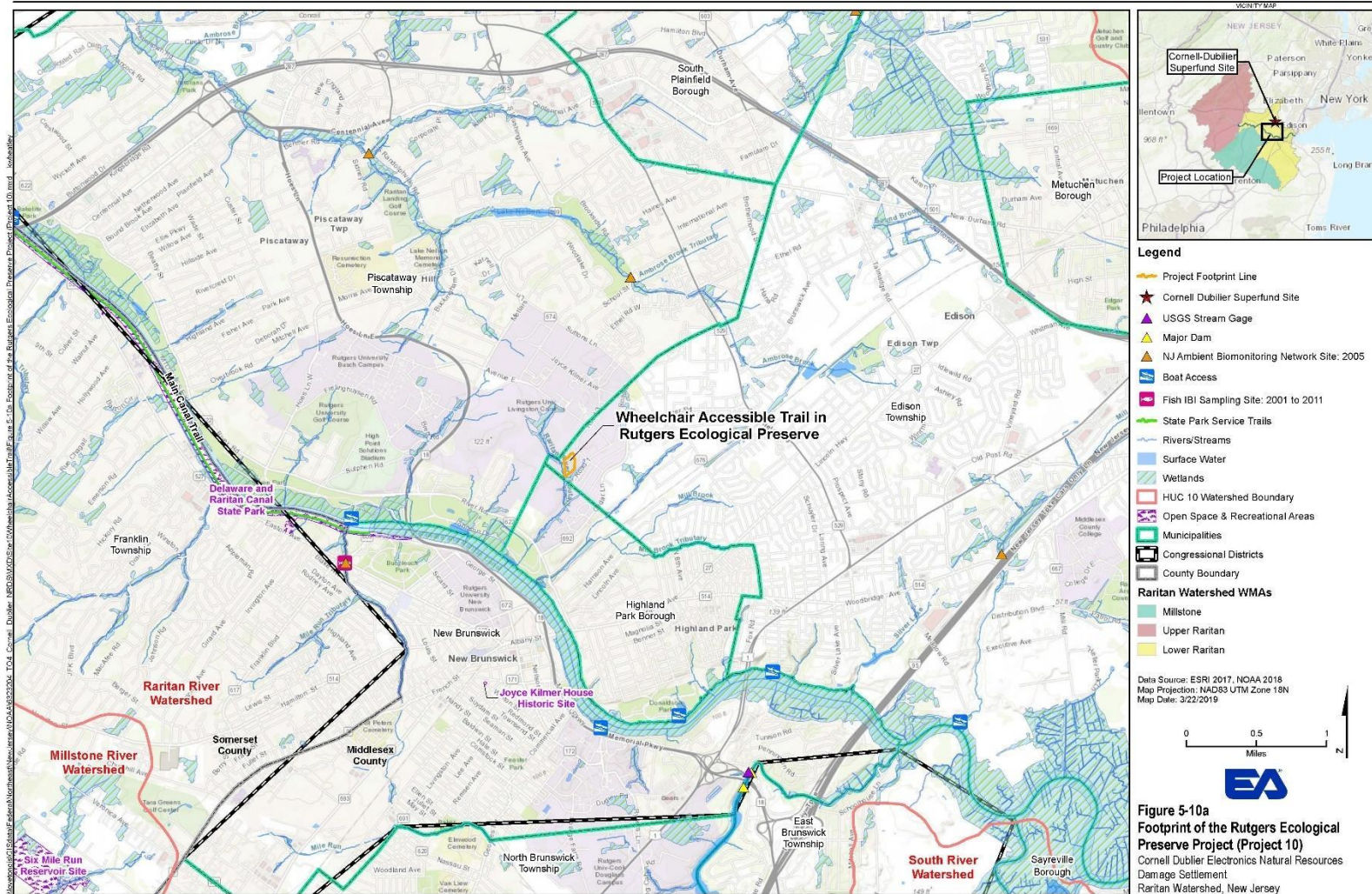
Implementation of the ADA-accessible trail at Rutgers Ecological Preserve would improve access for those visitors with wheelchairs and strollers. The ADA-accessible trail would allow visitor's access to Buell Brook. The addition of educational signs throughout the trail would inform visitors of the native flora and fauna and history of the area. Both the university and local community would benefit from the construction of the accessible trail.

5.10.6 Project Risks and Uncertainties

No specific project risks or uncertainties have been identified. The stakeholder provided an estimated cost of \$20,000 for this project and stated they currently do not have any available funds.

5.10.7 Resource Materials

No additional resource materials were available for this project.







5.11 SOUTH RIVER TIDAL MARSH RESTORATION (PROJECT 11)

5.11.1 Project Stakeholder(s)

The South River Tidal Marsh Restoration project was proposed by Rutgers University and may be implemented in partnership with the Borough of Sayreville and South River in Middlesex County, and with the Raritan Riverkeeper and Lower Raritan Watershed Partnership of New Jersey and New York. The project proponent has prepared a proposal of the project and has secured the support of local stakeholders.

5.11.2 Project Location and Background

The South River Tidal Marsh Restoration (Project 11) is a proposed marsh restoration project located 50 miles southeast of New York City near the Boroughs of South River and Sayreville, New Jersey, along the South River. The South River is 8 miles upstream of the mouth of the Raritan River (and is its first major tributary), which drains to Raritan Bay. The project site encompasses 301 acres of marsh situated south of CDE within the Lower Raritan River watershed and the South River watershed (Figure 5-11a). The site location is part of a larger, 650-acre tidal salt marsh that spans the shores of the South River. To the immediate (within 5 miles) east and north of the project site, there are two USGS stream gauges located along tributaries of the Raritan River, and three New Jersey Ambient Biomonitoring Network sites. Additionally, there is one recreational area (Cheesequake State Park) located approximately 2 miles south of the project area.

Ongoing studies of the area have shown that the communities adjacent to the South River, located in flood-prone areas, have a history of flooding following storms. The projected impacts of sea level rise will further exacerbate the impacts of future storms potentially resulting in continued socio-economic losses. While the South River salt marsh ecosystem has been spared from direct development, it is degraded in quality and does not provide optimal habitat for wildlife or maximum flood protection for landowners. In 2002, the U.S. Army Corps of Engineers (USACE), with project partner NJDEP, conducted an integrated FS and environmental impact statement (EIS) for the South River to determine the feasibility of hurricane and storm damage reduction and ecosystem restoration; the specific project footprint for this marsh restoration project was included in this evaluation (USACE 2002) as part of a much larger study area along the South River. Restored wetland habitat would serve as flood protection for adjacent communities, and provide high-quality, non-degraded habitat for aquatic and terrestrial species.

5.11.3 Proposed Restoration Action

The plan for ecosystem restoration in the FS/EIS (USACE 2002) identified specific restoration goals and objectives. Restoring biodiversity and ecological function were established as the restoration goals. The restoration objectives included: restoring habitat for threatened and endangered species, increasing site biodiversity, increasing tidal flushing, reducing common reed

(*Phragmites australis*), improving water quality, and stabilizing and protecting desirable wetland habitat.

The proposed action is a **wetland** project to **restore** and **enhance** tidal salt marsh. Specific project components would include:

- Creation of improved tidal marsh habitat;
- Expansion of high marsh habitat;
- Reduction and control of the common reed population;
- Implementation of shoreline erosion control measures; and
- Creation of living shoreline areas.

5.11.4 Site Conditions

The land within the project site is comprised of both public and private parcels. Most of the site is at least partially owned by the Borough of Sayreville, New Jersey (four parcels) (Figure 5-11b). Two smaller parcels are under private ownership. Complete tax parcel/ownership information was not available for this project site. In general, the study area communities contain a mix of older suburban residential development, industrial facilities, and commercial highway corridors (USACE 2002).

The existing wetland habitat within the project site consists of 262 acres of estuarine and marine wetlands (Figure 5-11c); there are also 38,836 ft. of streams within the footprint. Areas of freshwater emergent wetland is located to the southeast of the project area and forested/shrub wetlands are located to the north and south. The entirety of the project footprint is sited within the 100-year floodplain. Much of the area is covered by common reed population; common reed is an aggressive invasive species that can outcompete other wetland species, decreasing biodiversity and creating an area with low value habitat for fish and wildlife (USACE 2002). Most of the wetlands within the project area have been altered by anthropogenic activity including soil removal, dredge material deposition, brick/asphalt/concrete waste fill, and ditching for mosquito control (USACE 2002).

Implementation of this project would benefit numerous wildlife species; field surveys conducted prior to the FS/EIS for the South River (USACE 2002) found 12 mammal species and 80 bird species utilizing the project area. Specific target species identified by the project proponent are presented in Table 5-11a and include several birds and the bog turtle, which is federally listed as threatened.

Table 5-11a Target Species for the South River Tidal Marsh Restoration Project

Species Name	Type	Federal/State Listed Status
Northern Harrier (<i>Circus hudsonius</i>)	Bird	State Endangered
Peregrine Falcon (<i>Falco peregrinus</i>)	Bird	Not listed
Yellow-Crowned Night Heron	Bird	Not Listed
Osprey (<i>Pandion haliaetus</i>)	Bird	Not Listed
Bog Turtle (<i>Clemmys muhlenbergii</i>)	Reptile	Threatened – Federal

5.11.5 Natural Resource and Human Use Benefits

Implementation of the South River Tidal Marsh Restoration project would result in approximately 258 acres of restored wetland habitat (Table 5-11b).

Table 5-11c Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit(s) Gained
Tidal Wetland	Approximately 258 acres	Hydrologic connectivity, invasive species control, nesting and foraging habitat

The community would benefit significantly from implementation of the project, as the restored marsh lands would absorb more stormwater runoff and subsequently reduce the amount of flooding that occurs. This would reduce the need for frequent street closures due to flooding, and at-risk incidents. Hurricanes and other storms have caused severe flooding along the South River. Between 1962 and 1993, storms caused over \$32 million in damages. There are approximately 1,247 structures within the 100-year floodplain of the communities along the South River. In addition to damages resulting from tidal inundation, tidal surges often block existing stormwater drainage outlets, indirectly resulting in additional hurricane and storm damage. South River has 174 Repetitive Loss property claims amounting to over \$6 million in total losses and Sayreville has 56 Repetitive Loss property claims amounting to over \$5 million in total losses. Restored tidal marshes would also provide improved downstream water quality for the South River and the Raritan River watershed through reduction of erosion and sedimentation impacts.

There are few biodiverse tidal wetlands that perform high value ecological functions remaining in the Raritan River Basin (USACE 2002). The project design will include restoration of low and high salt marsh habitat, including removal/reduction of invasive species so that native species can flourish. Tidal marshes are EPA priority wetland habitats, identified as being capable of supporting diverse communities that provide spawning and nursery habitat for valuable fish species, as well as waterfowl that utilize the habitat for nesting or migratory flyover (USACE 2002). A restored wetland habitat will result in a restored aquatic community through water quality improvements and improved hydrologic connectivity. This ecosystem restoration, once implemented, along the South River would help to improve the local and regional ecology in the New York metropolitan area (USACE 2002).

5.11.6 Project Risks and Uncertainties

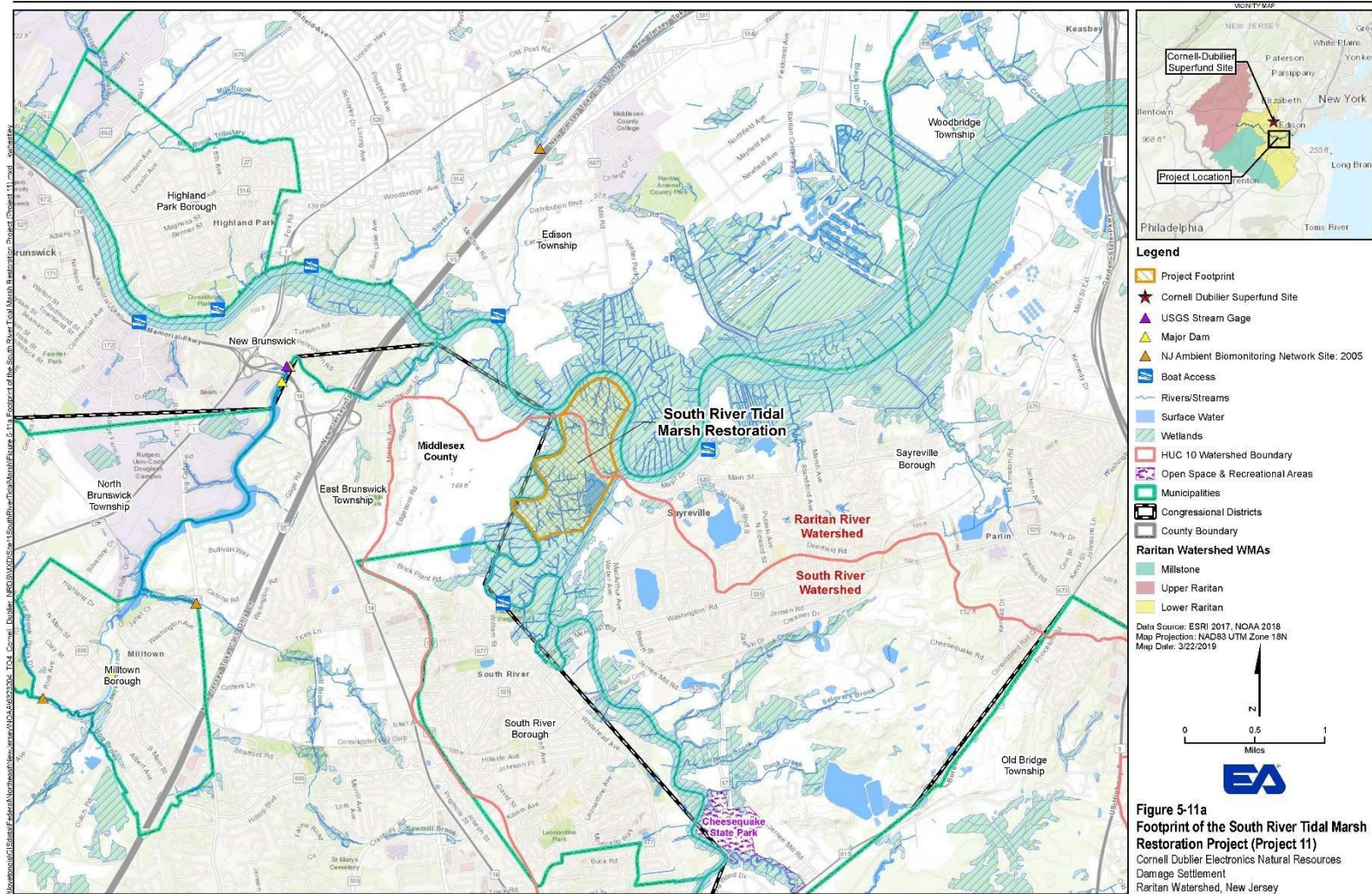
This project has potential risks/infeasibilities regarding site control/access, engineering design, and cost to complete. The stakeholder estimated that the project would cost \$250,000 to complete and that they currently do not have any available funds. Due to the industrialized nature of the surrounding project area, it is likely that the lands to be restored contain contaminants consistent with those present throughout the lower watershed. As such, the project presents a remedial challenge that will likely increase costs. However, in past years, the type of wetland enhancement suggested included in this project has been largely successful at other nearby sites.

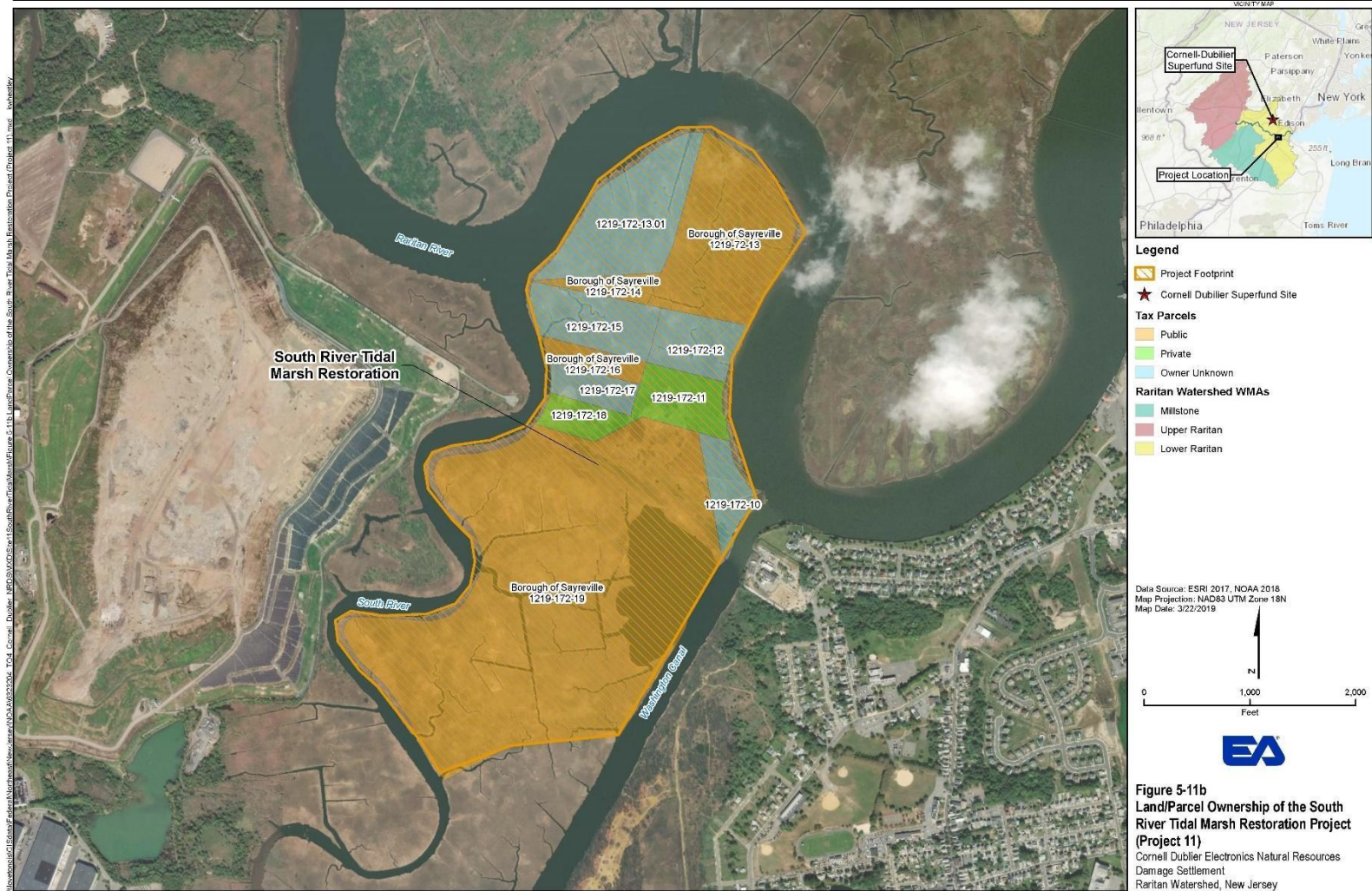
Wetland restoration in the South River has received strong support from state agencies, as well as affected local governments, including Middlesex County, the Borough of South River, and the Borough of Sayreville. According to the project stakeholder, the South River Tidal Marsh Restoration project has full support from the project partners and stakeholders.

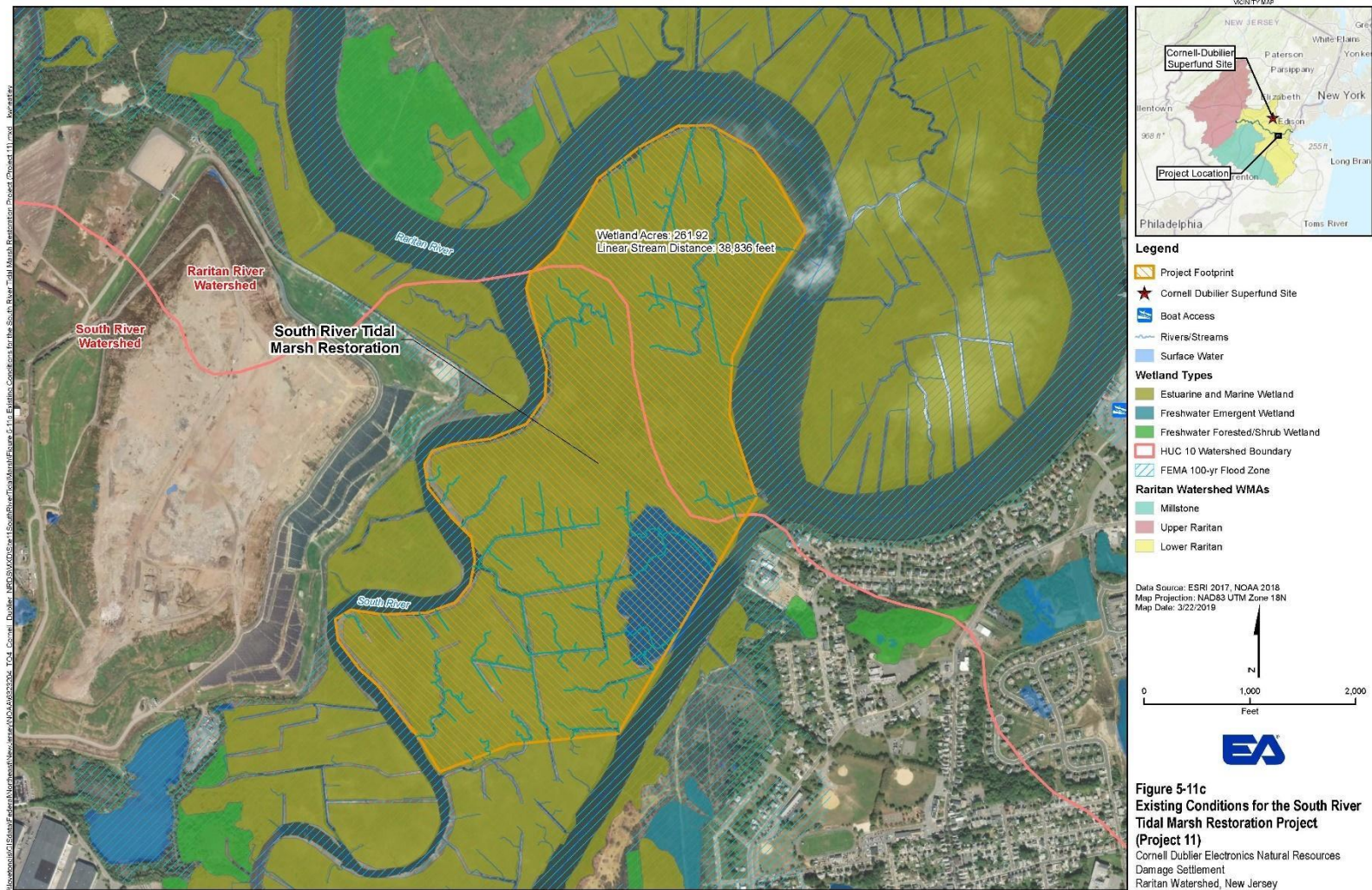
5.11.7 Resource Materials

Resources used in addition to those described in Section 5.1 include:

USACE. 2002. *South River, Raritan River Basin, Hurricane and Storm Damage Reduction and Ecosystem Restoration; Integrated Feasibility Study and Environmental Impact Statement, Volume 1*. USACE New York District, NJDEP. September.







5.12 PETER'S BROOK RIPARIAN ZONE (PROJECT 12)

5.12.1 Project Stakeholder(s)

The Peter's Brook Riparian Zone project was proposed by Rutgers University and may be implemented in partnership with the Borough of Somerville, Somerset County, New Jersey and the Lower Raritan Watershed Partnership. The project is in the conceptual planning stage.

5.12.2 Project Location and Background

The objective of the Peter's Brook Riparian Zone (Project 12) project is to revitalize the stream banks within a linear system of parks and open spaces that follow Peter's Brook in Somerville, Somerset County, New Jersey (Figure 5-12a). The project footprint includes one New Jersey Ambient Biomonitoring Network site and one Fish IBI sampling site. The project site is in the Raritan River watershed, within the Lower Raritan Watershed Management Area.

The stream bed of Peter's Brook consists of gravel and rock substrate that is significantly embedded in finer sediment in some areas, usually pool zones. Water quality is moderately impaired due to intense runoff from the high percentage of impervious surfaces in town and direct inflow from storm drains. NJDEP developed a Total Maximum Daily Load of fecal coliform for the stream that requires a 98 percent decrease in levels. The source is identified as primarily suburban stormwater runoff. Because of the combination of intense flooding and impaired water quality, Chamber's Park (at the south end of the linear system) is technically closed due to environmental contamination and health risk, although access is not prevented.

5.12.3 Proposed Restoration Action

This project describes a set of strategies that would **enhance** 1.5 miles of **riparian buffer** and improve recreational experiences within the linear park system at Peter's Brook. The proposed restoration actions found along Peter's Brook include:

- Flood-prone natural spaces could benefit from increased recreation use and community connection provided by bridges, terrace steps, green "islands," or streamside terrace gardens. Several of these would also function as flood control elements. The streamside terrace gardens, along with bank stabilization strategies such as live cribwalls, rootwad revetments, and natural fiber rolls and matting, would also address water quality and riparian habitat function when combined with supplemental native riparian planting expansion of high marsh habitat.
- Natural spaces have less need for flood mitigation. Recreational and community connection options for these spaces include terrace steps, steps and ramps, weir structures, elevated deck overlook, and infrastructure garden gateways. These would enhance the human value of these spaces while also supporting and enhancing the existing ecological integrity.

- Flood-prone social spaces could see improved flood conditions through the use of terrace steps, lifted lawn, streamside terrace gardens, or terrace walls. Several of these strategies would also supplement existing social access, as would bridges. The terrace walls and streamside terrace gardens, along with expanding the floodplain, would help to stabilize the stream banks and enhance water quality and riparian habitat when combined with native riparian planting and bank stabilization techniques.
- Social spaces with less of a flooding concern could take advantage of several strategies that would function to support use and community connection while also improving the ecology of the riparian system, including streamside grove, terrace steps, weir structures, and neighborhood edge parks implementation of shoreline erosion control measures.
- Leftover spaces require a combination of strategies that will significantly increase both human and ecological value. Bridges, terrace steps, and steps and ramps are proposed as options for access within these smaller edge spaces, with the goal of connecting them to both the stream and larger nearby spaces.

5.12.4 Site Conditions

The land within the project site is comprised of 10 public parcels, all owned by Somerville Borough (Figure 5-12b). This project is located along a linear system of public parks and open spaces. The existing wetland habitat within the project site consists of 4.36 acres of freshwater forested/shrub wetland (Figure 5-12c).

Although no specific target species were listed by the stakeholder, implementation of this project would likely benefit birds and mammals within the enhanced riparian corridor. An online review using the USFWS IPaC project review tool identified two mammal species listed as state or federally threatened or endangered species, or Species of Special Concern as being potentially present within the project site (Table 5-12a). No USFWS critical habitats are present within the project area.

Table 5-12a Listed Status Species Potentially Present at the Restoration of the Peter's Brook Riparian Zone Project Site

Species Name	Type	Federal/State Listed Status
Indiana Bat (<i>Myotis sodalis</i>)	Mammal	Endangered – Federal
Northern Long-Eared Bat (<i>Myotis septentrionalis</i>)	Mammal	Threatened – Federal

5.12.5 Natural Resource and Human Use Benefits

Implementation of the Restoration of the Peter's Brook Riparian Zone would result in 1.5 miles of enhanced stream miles and 0.2 acre of restored riparian buffer habitat (Table 5-12b).

Table 5-12b Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Instream habitat	1.5 miles	Erosion control, improved water quality
Riparian Buffer	0.2 acre	Native plantings, flood control

Currently the Peter's Brook Riparian Zone project is a high-level planning strategy to revitalize the habitat and enhance visitor experience with the system of parks along Peter's Brook. It is unclear what specific actions of those listed would be taken and, therefore, what the natural resource and human use benefit would be. However, some of the items suggested, such as native plantings, would improve habitat along the riparian corridor. There would also be human use benefit if bridges, ramps, and steps were installed to bring people closer to nature and wildlife in this park systems.

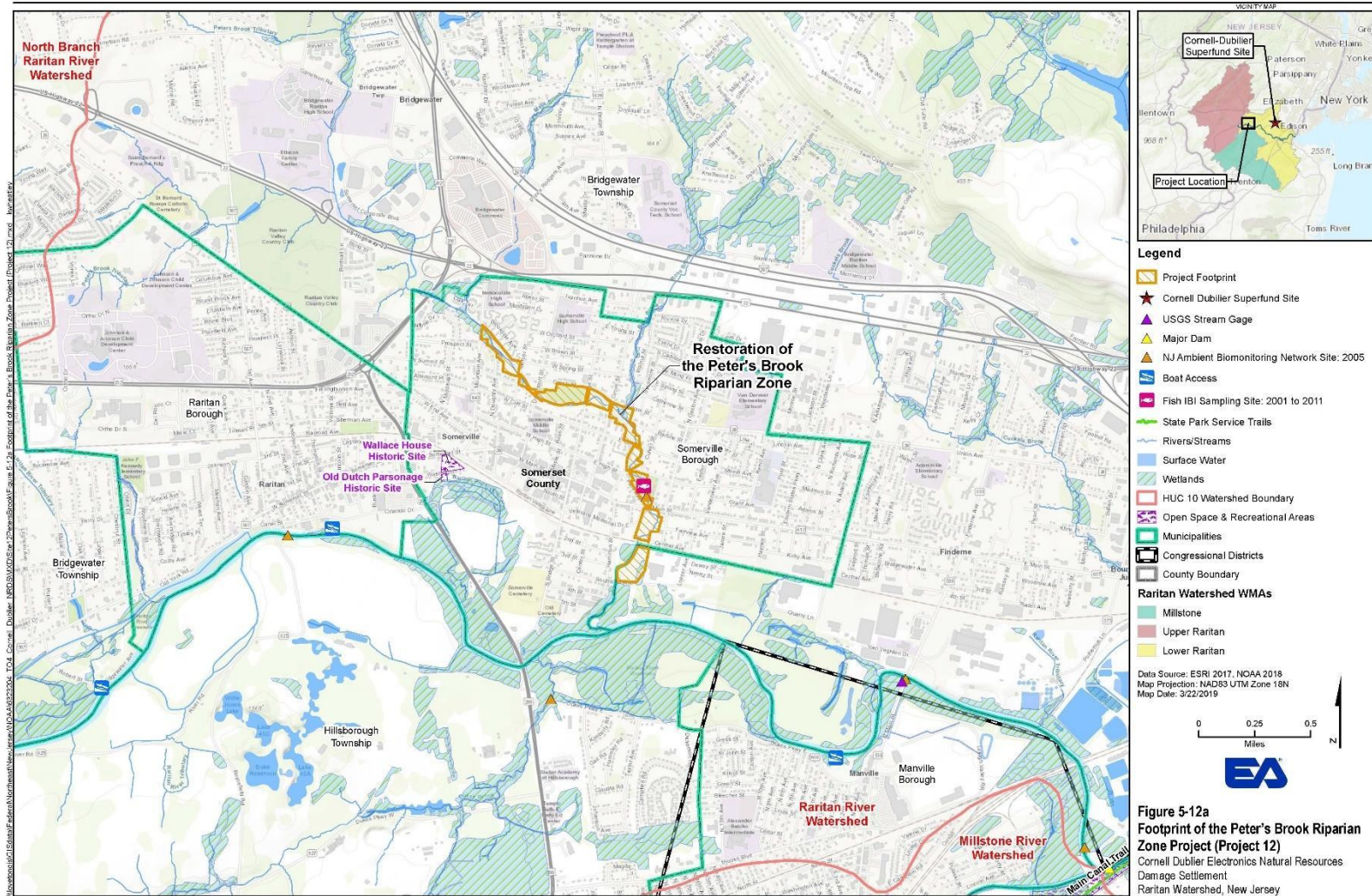
5.12.6 Project Risks and Uncertainties

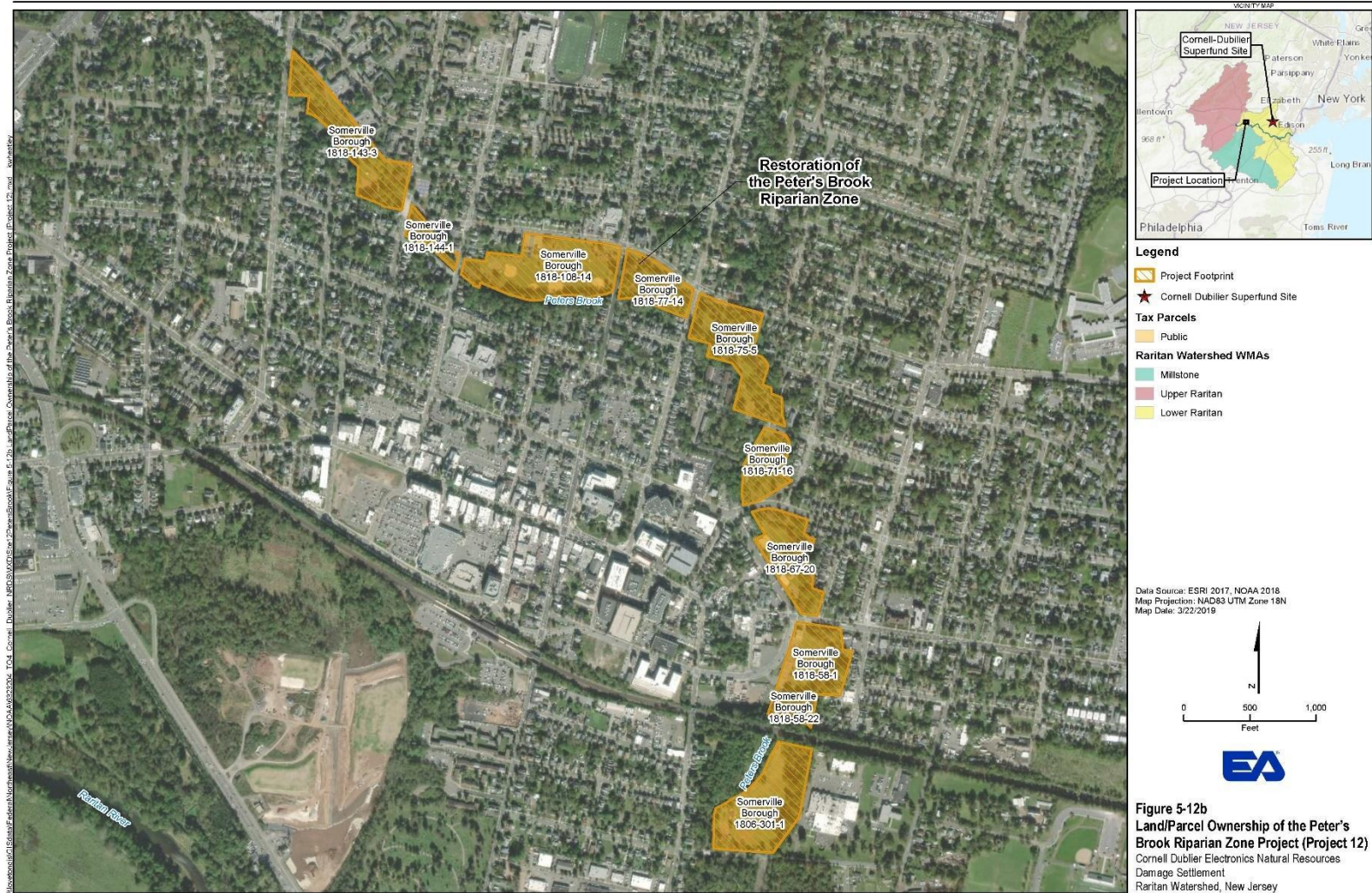
This project has potential risks/infeasibilities regarding site control/access, engineering design, permitting and high costs. As submitted, the Peter's Brook Riparian Zone project presents multiple alternatives; project alternatives would need to be assessed before risks and uncertainties could be fully addressed. The stakeholder provided an estimated cost of \$300,000 for this project and stated they currently do not have any available funds. Beyond this cost estimate, there is limited information available regarding potential project risks and uncertainties.

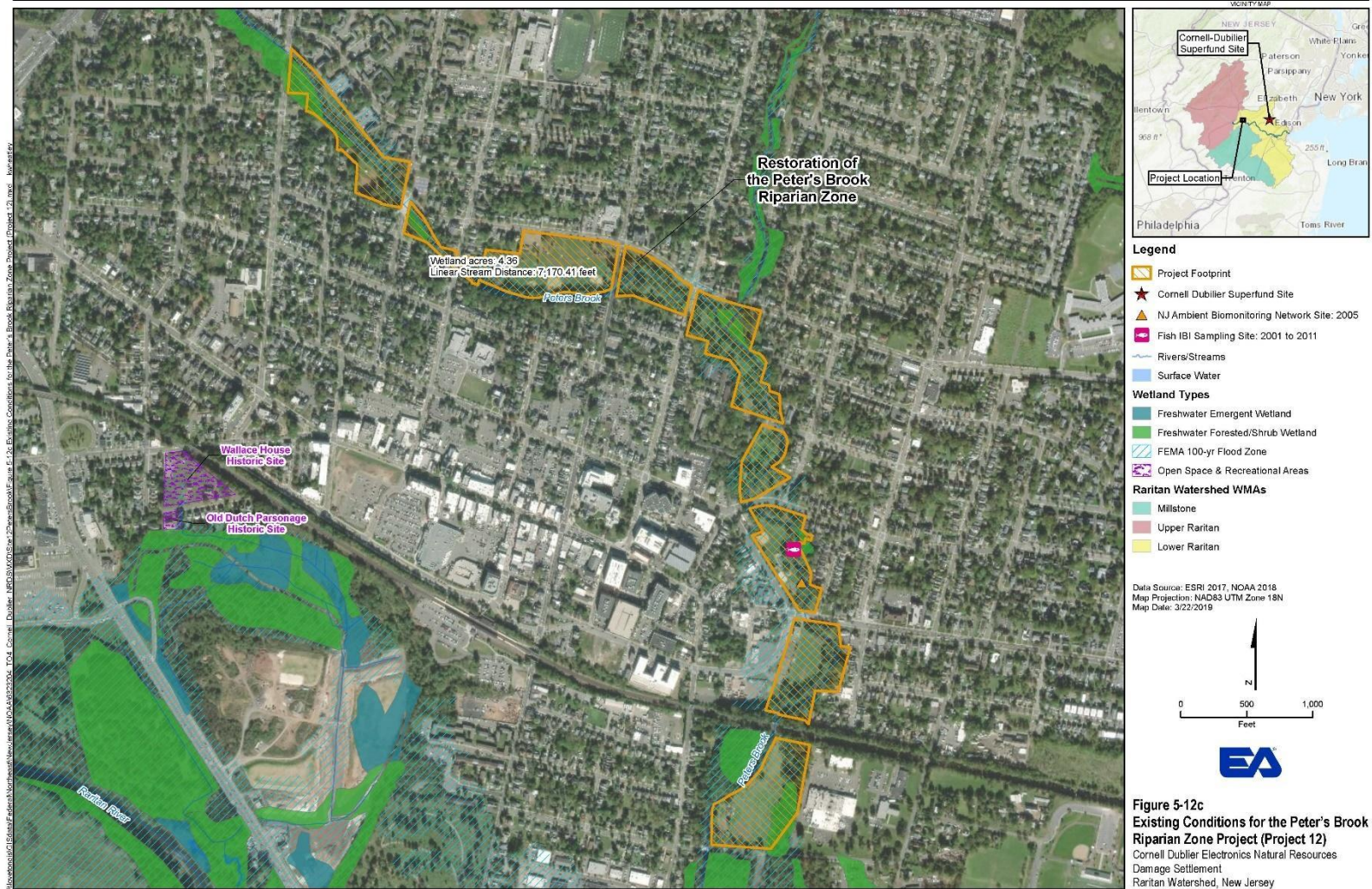
5.12.7 Resource Materials

Resources used in addition to those described in Section 5.1 include:

Pilla, M. Streambank Revitalization in Somerville, New Jersey: A Case Study in Planning Strategy for the Integration of Ecological and Social Needs in Public Open Space. Master's Thesis.







5.13 RARITAN RIVER TRAIL CONNECTOR (PROJECT 13)

5.13.1 Project Stakeholder(s)

The Raritan River Trail Connector project was proposed by the Borough of Highland Park and may be supported by Middlesex County, New Jersey and the NJDEP Land Use and Natural and Historic Resources Division. Possible grants may be acquired from the North Jersey Transportation Planning Authority and New Jersey Department of Transportation. This project is currently in the early concept phase.

5.13.2 Project Location and Background

The Raritan River Trail Connector would be located in Highland Park, New Jersey, approximately 30 miles southwest of New York City. The connector trail would be located along the Raritan River between Donaldson Park and Johnson Park (Figure 5-13a). The connector trail would be approximately 1 mile long and is situated south of CDE within the Lower Raritan River watershed (Figure 5-13a). A New Jersey Ambient Biomonitoring Network site is located approximately 3 miles west of the project site. A Fish IBI sampling site is also located in the same location as the New Jersey Ambient Biomonitoring Network site. Raritan River boat access is located at Donaldson Park less than a mile from the project site and 2.25 miles further downstream at the Edison Boat Launch.

Donaldson Park and Johnson Park are heavily used parks located along the Raritan River just downstream and upstream of the project site. Donaldson Park is approximately 80 acres and was opened in 1946. To accommodate the thousands of visitors each week, the park was renovated in 2009. A variety of recreational facilities are available at Donaldson Park including sports fields, playgrounds, paved trails, picnic areas, boat ramp, community garden, and dog park.

Johnson Park is approximately 478 acres and is named after the pharmaceutical firm Johnson & Johnson. This park includes multiple sports fields, picnic areas, playgrounds, ponds, a 2.5-mile bike/walkway, cricket patches, an old town village, and an animal haven featuring farm and exotic animals. Visitors to the Donaldson and Johnson parks are unable to safely travel from one park to the other without using busy streets and intersections, including State Route 27. This project would allow a safe connection between the two major county parks along the Raritan River.

5.13.3 Proposed Restoration Action

The proposed action is a **recreation** project to **create** a 1-mile multi-use trail along the Raritan River that would connect Donaldson and Johnson parks, while also connecting residents and visitors to the Raritan River. The connection would also complete an important segment of the East Coast Greenway, a walking and biking route that connects popular cities from Maine to Florida. Specific project components include:

- Creation of a primary connector trail would be approximately $\frac{3}{4}$ mile long and would run along the bank of the Raritan River. The trail would be located between State Route 27 and the west edge of Donaldson Park. The proposed trail would be constructed on an existing utility access drive near the river bank with either asphalt or other solid surface material.
- Construction of a 10-ft-wide boardwalk for the proposed trail south of Skyview Terrace leading to Donaldson Park. This area is slightly lower elevation with existing scrub growth that is well suited for a boardwalk. The boardwalk would be constructed of wood and would be anchored to the ground with footings.
- Construction of a small pedestrian bridge at the corner of South Adelaide Avenue and Valley Place. In this area a small ravine formed by stormwater runoff extends to the river edge. The small pedestrian bridge would traverse this ravine. The bridge would be prefabricated or custom built to accommodate both foot and bicycle traffic as well as utility service vehicles.
- Construction of a series of steps along the hillside leading from the roadway to the river edge, to address significant elevation changes that occur on the north end of the connector trail at the intersection of the south side of State Route 27 and River Road. The proposed stairway would be constructed into the hillside with concrete construction methods or built on top of the hill with an elevated wooden stairway.
- Construction of a channel within the stairway surface to assist bicyclists with carrying bicycles up and down the stairs.
- Siting of multiple river access points or rest areas along the proposed connector trail to allow visitors views of the Raritan River and New Brunswick skyline, designated fishing opportunities, and interpretive/educational opportunities.

In addition to the construction of the connector trail, boardwalk, ravine, and staircase, improvements are proposed at the State Route 27 and River Road intersection. The proposed improvements include sidewalk upgrades, updated road striping alignments, improved signaling, and improved signage.

5.13.4 Site Conditions

The land within the project site is comprised of four private parcels and two public parcels of land. In addition, two parcels of land along the connector trail have unknown ownership (Figure 5-13b).

The proposed connector trail is located along the mainstem of the Raritan River. Approximately 2.66 acres of estuarine and marine wetlands area are located at the south end of the proposed connector trail adjacent to Donaldson Park (Figure 5-13c). An unnamed stream flows through the project area and enters the Raritan River west of the wetland area. Historically this stream

was fed from runoff of the neighboring community; however, today the stormwater system in this area feeds the stream. The entire connector trail except for the trail located north of State Route 27 is located within the 100-year floodplain. (Figure 5-13c).

The Highland Park Borough Council passed a Riparian Buffer Conservation Zone Ordinance (§230-194 et seq.) in 2011 which requires a minimum 50-ft riparian buffer along the Raritan River. Within the project area, the riparian area is dominated by deciduous vegetation including oak, beech, and hickory trees. A small area of shrubland is located at the south end of the project area near Skyview Terrace. The wetland area is dominated by common reed (*Phragmites australis*) (Highland Park Environmental Commission 2012).

Commonly sighted birds within the area include Red-Tailed Hawk (*Buteo jamaicensis*), Canada Goose (*Branta canadensis*), Osprey (*Pandion haliaetus*), Turkey Vulture (*Cathartes aura*), Black Vulture (*Coragyps atratus*), Double-Crested Cormorant (*Phalacrocorax auritus*), and Red-bellied Woodpecker (*Melanerpes carolinus*). Mammals including Muskrat (*Ondatra zibethicus*), Opossum (*Didelphis virginiana*), Raccoon (*Procyon lotor*), Eastern Gray Squirrel (*Sciurus carolinensis*), and White-tailed Deer (*Odocoileus virginianus*) can be found within the project location. The project area also provides habitat to a variety of reptiles and amphibians including Eastern Box Turtle (*Terrapene carolina carolina*), Eastern Garter Snake (*Thamnophis sirtalis sirtalis*), Redback Salamander (*Plethodon cinereus*), and American Toad (*Anaxyrus americanus*). Some of the fish that have been caught in the Raritan River in Highland Park include American Eel (*Anguilla rostrata*), Largemouth Bass (*Micropterus salmoides*), Yellow Perch (*Perca flavescens*), sunfish (*Lepomis* spp.), trout (Salmonidae), and carp (Cyprinidae) (Highland Park Environmental Commission 2012).

5.13.5 Natural Resource and Human Use Benefits

Implementation of the Raritan River Trail Connector project would enhance pedestrian and bicycle safety when crossing State Route 27. These improvements would complete connections between two major county parks. Visitors would have improved access to the Raritan River and additional educational opportunities. Overall the project would improve safety and access for pedestrians traveling to and from New Brunswick.

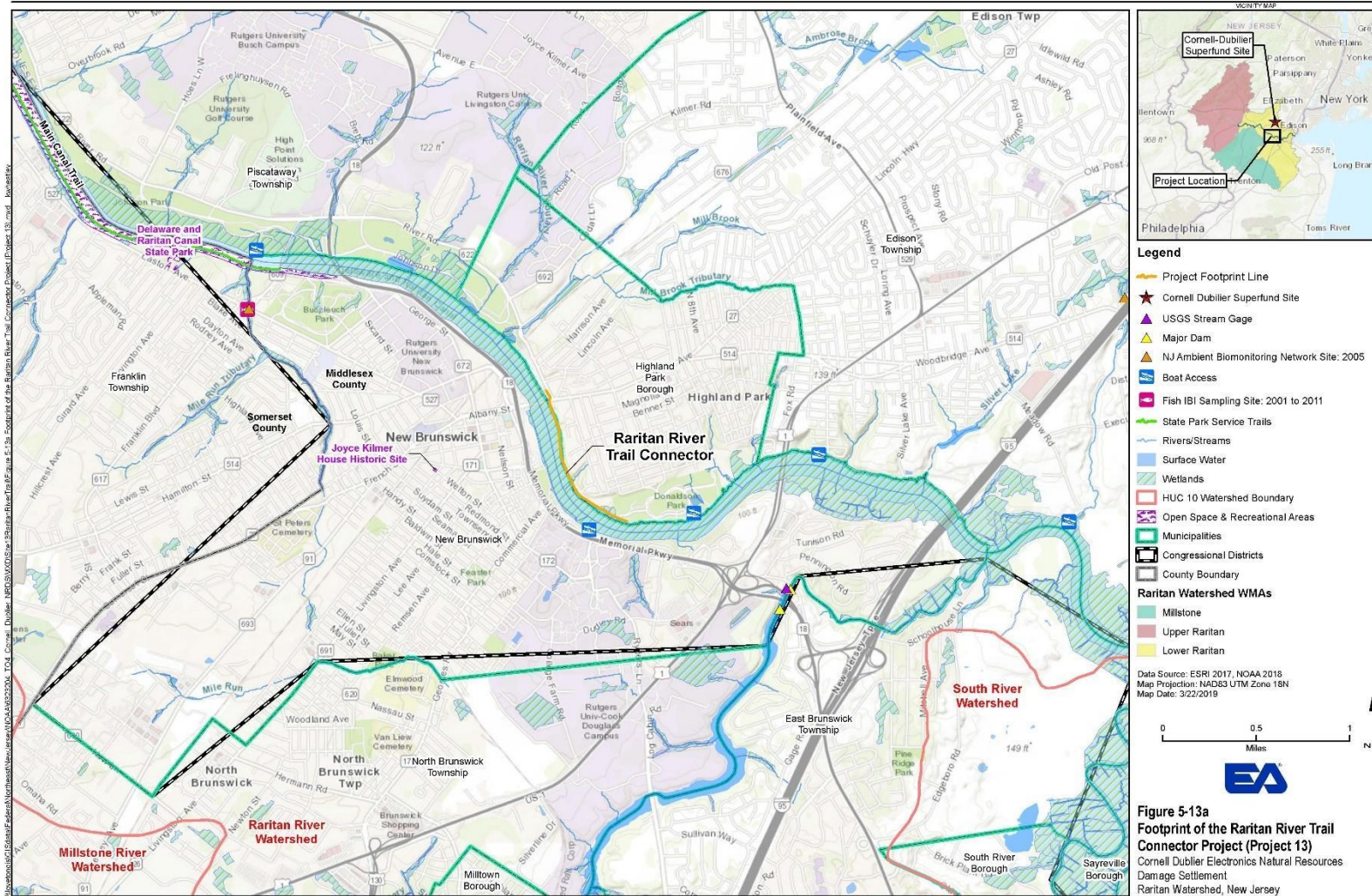
5.13.6 Project Risks and Uncertainties

This project has potential risks/infeasibilities regarding site control/access, engineering design, and cost to complete. Specific project challenges may include acquiring access agreements for private property, engineering work in narrow corridors, and work around bridges and road crossings. Special attention would need to be given during construction to avoid unnecessary destabilization and/or removal of riverbank trees. The stakeholder provided an estimated cost of \$1,900,000 to complete this project, and they currently do not have any available funds.

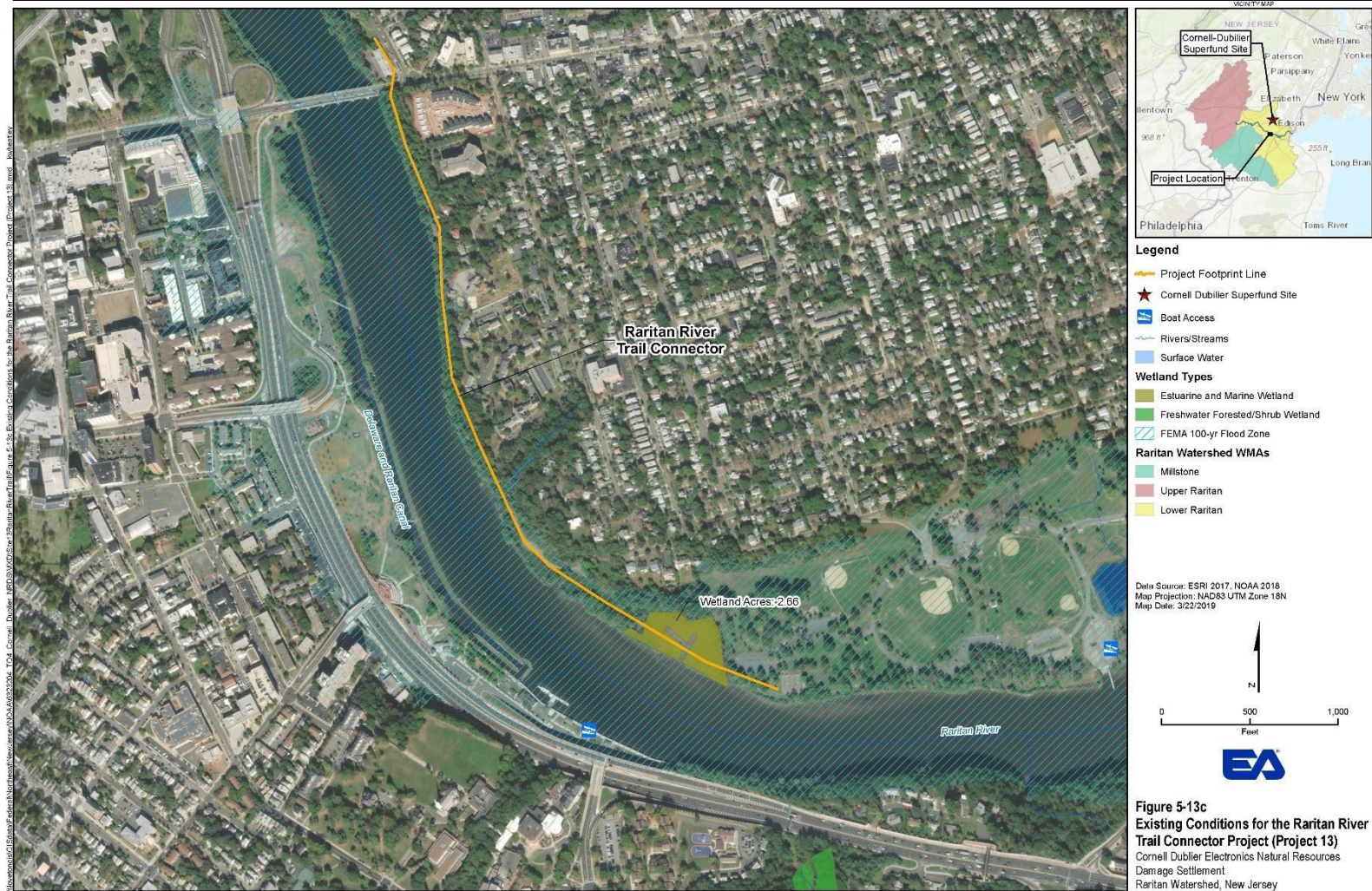
5.13.7 Resource Materials

Resources used in addition to those described in Section 5.1 include:

Highland Park Environmental Commission. 2012. *Environmental Resource Inventory for the Borough of Highland Park, Middlesex County, New Jersey*. February.







5.14 REMOVAL OF IMPERVIOUS SURFACES AND REFORESTATION OF LOST VALLEY (PROJECT 14)

5.14.1 Project Stakeholder(s)

The Removal of Impervious Surfaces and Reforestation of Lost Valley project was proposed by the Borough of Manville, New Jersey, and may be supported by The Watershed Institute and The Nature Conservancy. Some work has been performed in phases, but additional funding is needed to complete all phases of the project.

5.14.2 Project Location and Background

The Lost Valley area is located southwest of the CDE Superfund Site, along the mainstem of the Millstone River within the Millstone River Watershed, just downstream of the confluence of the Raritan and Millstone rivers (Figure 5-14a). There are three Fish IBI sampling locations surrounding the project site, and ten New Jersey Ambient Biomonitoring Network sites. The Delaware and Raritan Canal Park is located adjacent to the site (Figure 5-14a).

The Borough of Manville is in the process of restoring this area known as Lost Valley. The Lost Valley has experienced historic flooding issues caused largely by the removal of about 200 homes through the NJDEP's Blue Acres program. The Borough is pursuing this opportunity with The Nature Conservancy to restore the area back to its historic condition. The goal of the project is to create a Lost Valley Nature Park within the project site. To date, actions undertaken toward this goal have included conversion of a previously mowed/maintained field (1 acre) to pollinator habitat, by ceasing maintenance and allowing pollinator plants to regenerate. In this area, regrowth is already occurring, and wildlife is utilizing the site. The Borough is interested in continuing phases of this project to alleviate flooding and provide the community with a park resource for recreation.

A Master Plan Study was undertaken to provide a guide to the Borough of Manville for developing the new Nature Park. The plan analyzed the existing conditions and planned the proposed park improvements. The analysis involved evaluating existing characteristics of the parkland including topography, waterbodies, existing vegetation, circulation, potential for flood hazard, and regulated areas.

5.14.3 Proposed Restoration Action

The plan proposes new tree plantings, restoration of mowed fields into pollinator habitat, and a boat ramp near the site of the recently removed Weston Mill Dam, access to the river for fishing and boating, trails, boardwalks, and interpretive signage to engage visitors in the importance of maintaining floodplains for management of stormwater. Currently, the conceptual plan is being implemented in phases as funding becomes available.

The proposed action is a **reforestation, restoration, and construction** project to **restore and create** floodplain habitat. Specific project components would include:

- Stormwater management construction;
- Removal of impervious surface and reforestation of those areas;
- Conversion of mowed fields into pollinator habitat;
- Creation of a picnic grove and rain gardens;
- Construction of a boat ramp near the recently removed Weston Mill Dam (see separately Project #6);
- Improved pedestrian and vehicular circulation;
- Improved access to the river for recreational activities; and
- Construction of boardwalks and creation of interpretative signage to engage visitors in the importance of maintaining floodplains for stormwater management.

5.14.4 Site Conditions

The project site is largely comprised of public parcels owned by the Borough of Manville and Somerset County (Figure 5-14b). In general, the study area is mostly residential with some undeveloped tracts. The Lost Valley neighborhood is bound by the Conrail rail line to the north and on its remaining sides by the Raritan River to the northeast, Millstone River to the southeast, and Royce Brook to the southwest. The Lost Valley Neighborhood was comprised of roughly 500 homes and businesses, but following unprecedented flooding events, local, county, state, and federal buyout programs reduced the community to 377 homes and 4 commercial properties in Lost Valley (Lost Valley Master Plan).

Within the project footprint, there are 8.8 acres of forested scrub/shrub and emergent marsh habitat (Figure 5-14c). The habitat immediately to the east and south of the site also contains these wetland types (Figure 5-14c). Stream habitat within the project site totals 1,229 linear ft. The project site is located within the 100-year floodplain (Figure 5-14c).

The project site is largely impervious cover with some wetlands; there are no specific target species for this project, but reforestation of the area and conversion to a nature park will benefit wildlife species within the area by creating suitable habitat. An online review using the USFWS IPaC project review tool identified two mammals and one reptile species listed as state or federally threatened or endangered species as being potentially present within the project site (Table 5-14b). No USFWS critical habitats are present within the project area.

Table 5-14a Listed Status Species Potentially Present at the Removal of Impervious Surface and Reforestation of Lost Valley Project Site

Species Name	Type	Federal/State Listed Status
Indiana Bat (<i>Myotis sodalis</i>)	Mammal	Endangered – Federal
Northern Long-Eared Bat (<i>Myotis septentrionalis</i>)	Mammal	Threatened – Federal
Bog turtle (<i>Clemmys muhlenbergii</i>)	Reptile	Threatened – Federal

5.14.5 Natural Resource and Human Use Benefits

Implementation of the Removal of Impervious Surface and Reforestation of Lost Valley project would result in the enhancement and/or protection of 56 acres of floodplain habitat and creation/enhancement of 65 acres of human recreation area (Table 5-14b).

Table 5-14b Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Floodplain	56 acres	9 acres of planting and meadow seeding 2 acres for pollinator garden 1 acre for rain gardens 1 acre for picnic groves 1 acre of roads converted to lawn 42 acres of lawn and vegetated area protected
Human Recreation Areas	65 acres	4 acres of active recreation fields 31 acres of passive recreation area including trails 25 acres of lawn 30 acres forested/vegetated habitat

Removal of the impervious surface cover at the site would help to fully restore the floodplain. Simultaneously, a reforestation project would assist the site in providing the flood management it is intended to maintain and act as a catalyst for establishing the Nature Park. The focus of this project would be to transform the former neighborhood into a cohesive multi-use park, bringing together existing active recreation and expanding existing passive recreation opportunities. The park would be designed to employ smart growth and strategic planning.

Lost Valley Nature Park has the potential to be an exceptional example of transforming an area that is thought of as an impediment to a community asset. Developing the park in a way that brings back the natural appearance of a floodplain with areas that can be utilized as an ecological learning center with the pollinator garden, wetland meadows, upland meadows, rain gardens, and riparian zone plantings will accomplish this goal. Maintaining the active recreation components will give the park a neighborhood aesthetic, while providing a regional destination to explore an environmentally vital ecosystem to the Raritan and Millstone Rivers.

5.14.6 Project Risks and Uncertainties

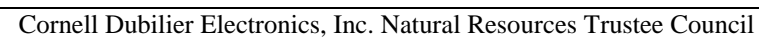
The project stakeholder did not identify risks for this project; however, NJDEP has regulated areas within the park that will require a permit from the state and these environmentally sensitive areas may affect how the park is developed. Flood hazard area, riparian zone and wetland permits may be required for many of the future projects. The stakeholder provided an estimated cost of \$50,000 for this project and stated that they currently do not have any available funds.

5.14.7 Resource Materials

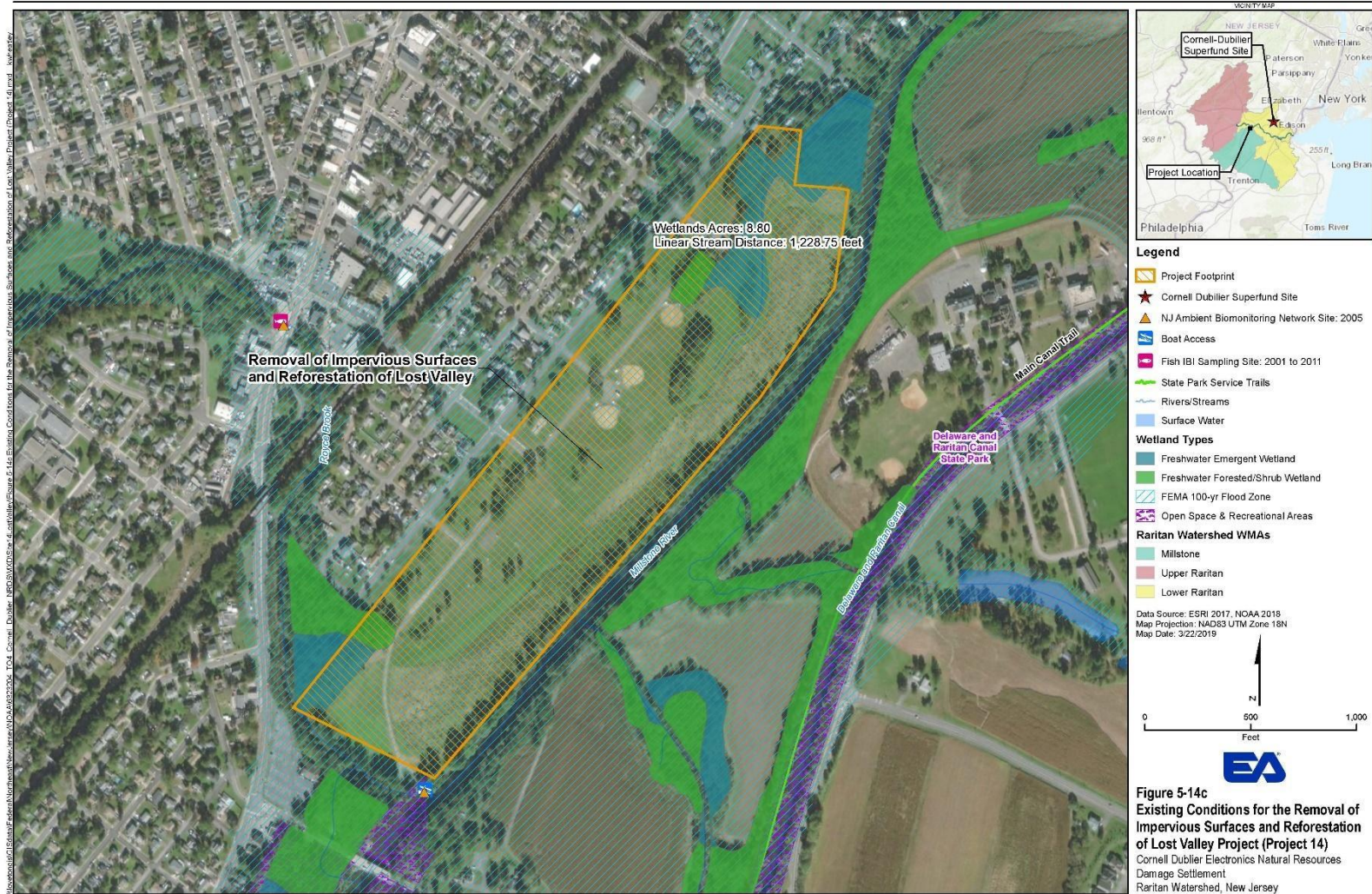
Resources used in addition to those described in Section 5.1 included:

Lost Valley Master Plan (provided by stakeholder)

Lost Valley Nature Park Recommendations Report (provided by stakeholder)







5.15 EDISON LANDFILL CAPPING AND WETLAND RESTORATION (PROJECT 15)

5.15.1 Project Stakeholder(s)

The Edison Landfill Capping and Wetland Restoration project was proposed by NJDEP. Landfill closure plans have previously been rejected by NJDEP multiple times because of a lack of specific information.

5.15.2 Project Location and Background

The Edison Landfill Capping and Wetland Restoration (Project 11) is a proposed capping of the landfill and restoration of the wetland adjacent to the landfill located along the Raritan River at the end of Meadow Road in Edison Township, Middlesex County, New Jersey. The landfill is located just south of the Kin-Buc Landfill Superfund Site. The site is north of the river on bank-left where it lines the river for 4,839 ft. The Raritan River eventually drains into Raritan Bay (Figure 5-15a).

The landfill consists of two main areas: the main mound and, to the southwest, the Environmental Benefit Area, each consisting of 35 acres for a total of 70 acres. The main landfill mound is unlined and accepted waste between 1958 and 1990. The Environmental Benefit Area is also unlined and accepted waste during the 1950s and 1960s. Here surficial waste is exposed along the edge of the Raritan River. The landfill accepted municipal solid waste, construction debris, dry industrial waste, animal processing waste, and vegetative and bulky waste. It is also possible other types of waste were accepted at certain times. Landfill gas used to be collected and sold, but a fire destroyed these systems and vents now pass gases straight to the atmosphere. Groundwater monitoring results show that some parameters were detected or exceeded Ground Water Quality Standards. Currently there is no plan for closure since NJDEP found the proposed closure plans to be deficient and would not approve them.

5.15.3 Proposed Restoration Action

The proposed action is a 26.9-acre wetland **restoration** project that will restore a waste-filled and degraded wetland by removing the waste, soils and sediments that overlay the natural wetland formation. The site will then be regraded and brought to an elevation where it can sustain native saltwater wetland marsh grasses. Some clean backfill may be necessary to bring the elevation to proper grade after removal of the waste materials. The waste materials extracted from the wetland project area will then be moved to the surface of the main mound and capped over with clean fill. Specific project components would include:

- Excavation and Removal of municipal waste, soils and sediments in the lower landfill (wetland area);
- Backfilling with clean sand soils and regrading of the newly reconstructed wetland area;
- Relocation of the removed waste to the main mound and capping of that waste;

- Planting the wetland site with native tidal salt marsh grasses and protection of those grasses for a time with a goose exclusion fence.

5.15.4 Site Conditions

The land within the project site is comprised of 13 parcels of land (Figure 5-15b). Complete tax parcel/ownership information was not available for this project site, but it is known that at least three parcels are owned by Edison Township, and at least one parcel is owned by the Clean Land Fund.

The existing habitat within the project site is classified as estuarine and marine wetland. The land surrounding the site is considered freshwater forest/shrub wetland or estuarine and marine wetland. The entirety of the project footprint is sited within the 100-year floodplain (Figure 5-15c). Waste at the main mound is approximately 80 to 100 ft. thick and is covered with 1 to 4 ft. of soil. The Environmental Benefit Area is heavily vegetated, and waste is exposed along the river's edge.

Implementation of this project would benefit numerous wildlife species; specific target species identified by the proponent are presented in Table 5-15a and include native wetland plants and several types of fish.

Table 5-15a Target Species for the Edison Landfill Restoration Project

Species Name	Type	Federal/State Listed Status
American Eel (<i>Anguilla rostrata</i>)	Fish	Species of Concern
Blueback Herring (<i>Alosa aestivalis</i>)	Fish	Species of Concern
American Shad (<i>Alosa sapidissima</i>)	Fish	Species of Concern – State
Native Wetland Plants (<i>Spartina</i> species)	Plants	Not Listed

5.15.5 Natural Resource and Human Use Benefits

Implementation of the Edison Landfill Restoration would result in 26.9 acres of restored wetland habitat (Table 5-15b), addressing water quality issues arising from the abandoned, unlined landfill.

Table 5-15b Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Wetland	26.9 acres	Improved surface water quality, improved groundwater quality

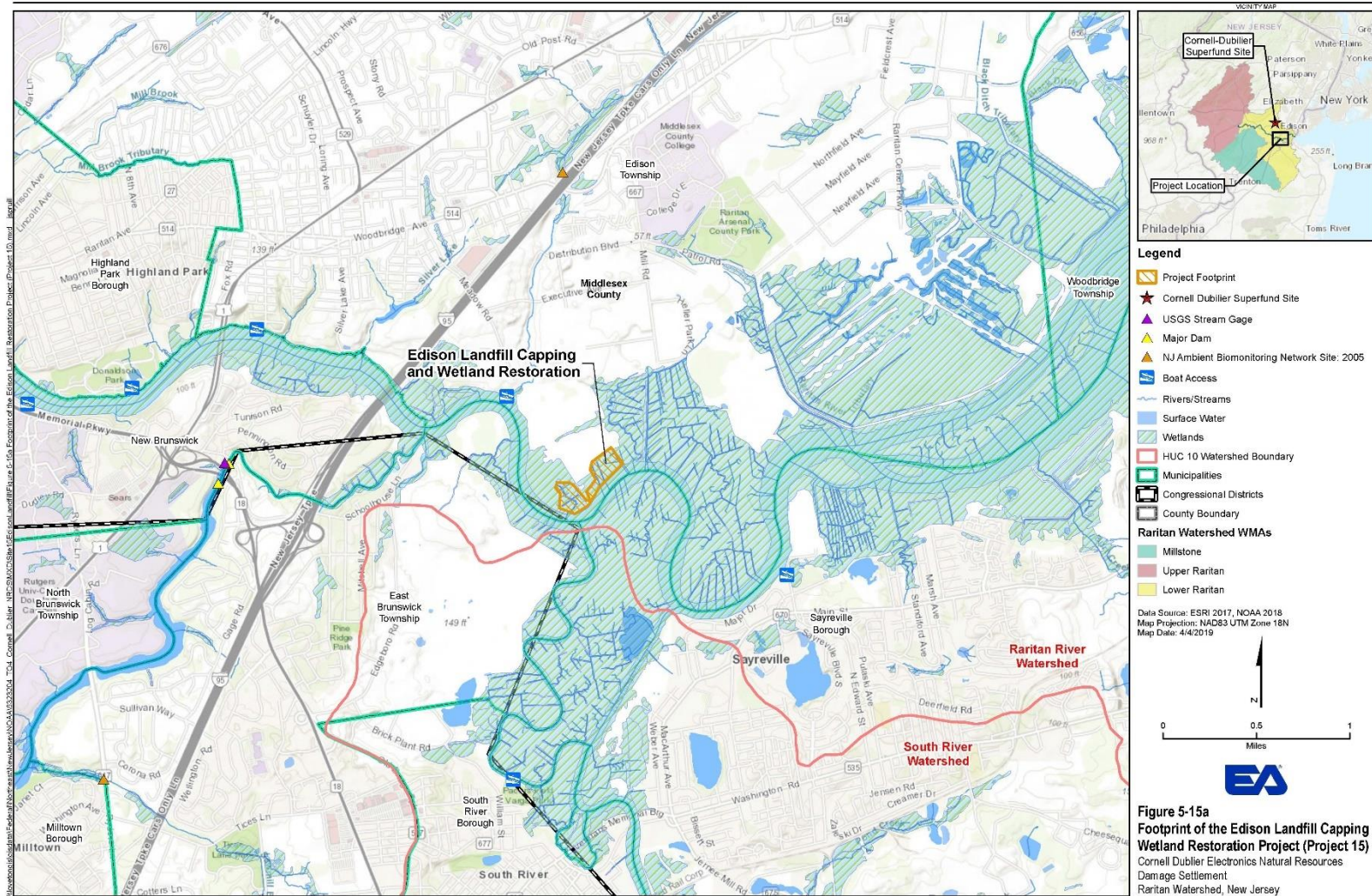
The current main landfill would be covered over with a clean fill cap. The surrounding marsh plain would then be excavated and regraded to lower the surface elevation to improve tidal flushing. Replanting of native marsh plant species would encourage native wetland plant species to flourish, especially *Spartina* species. The project would also improve the landfill area aesthetically.

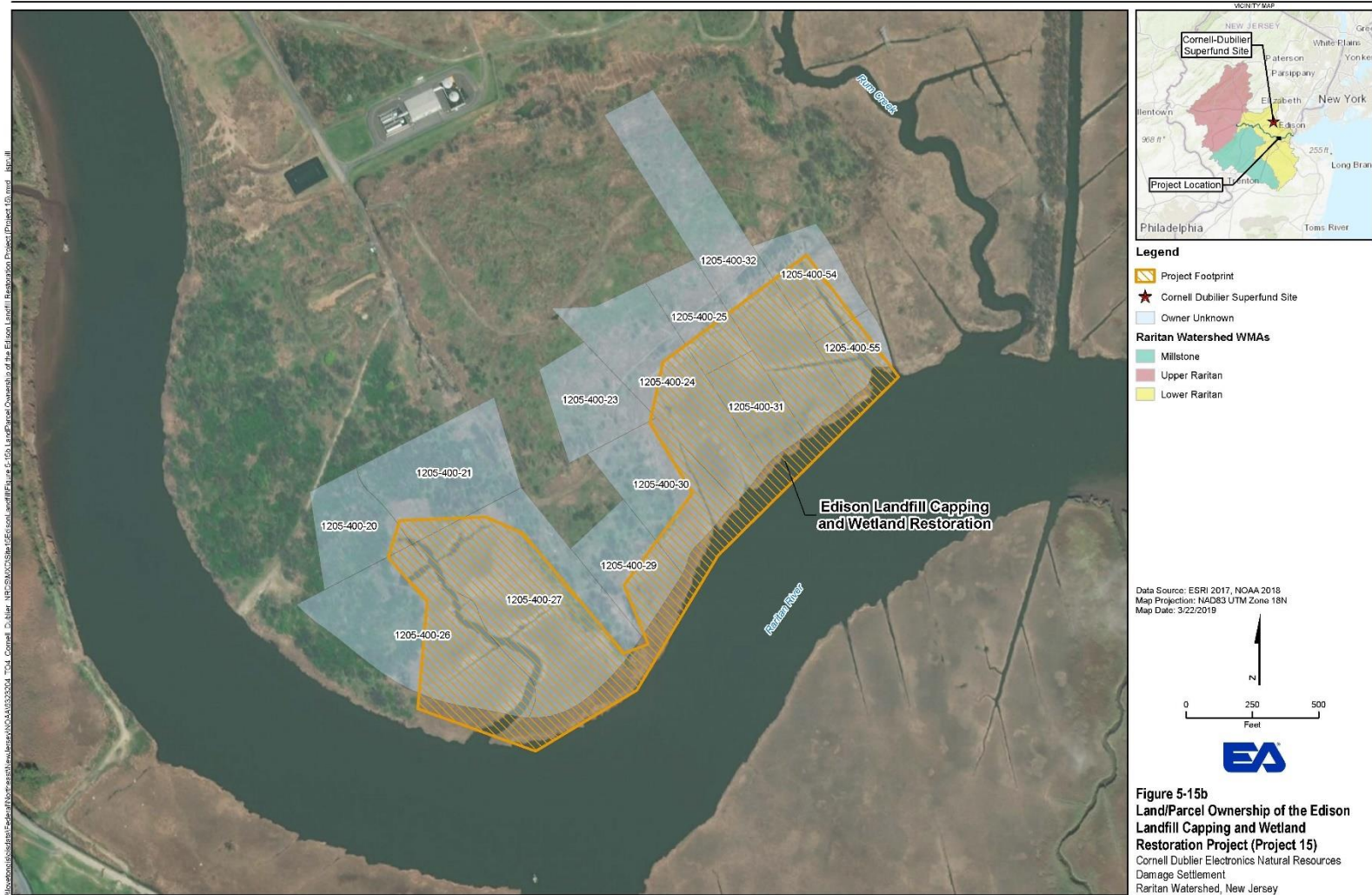
5.15.6 Project Risks and Uncertainties

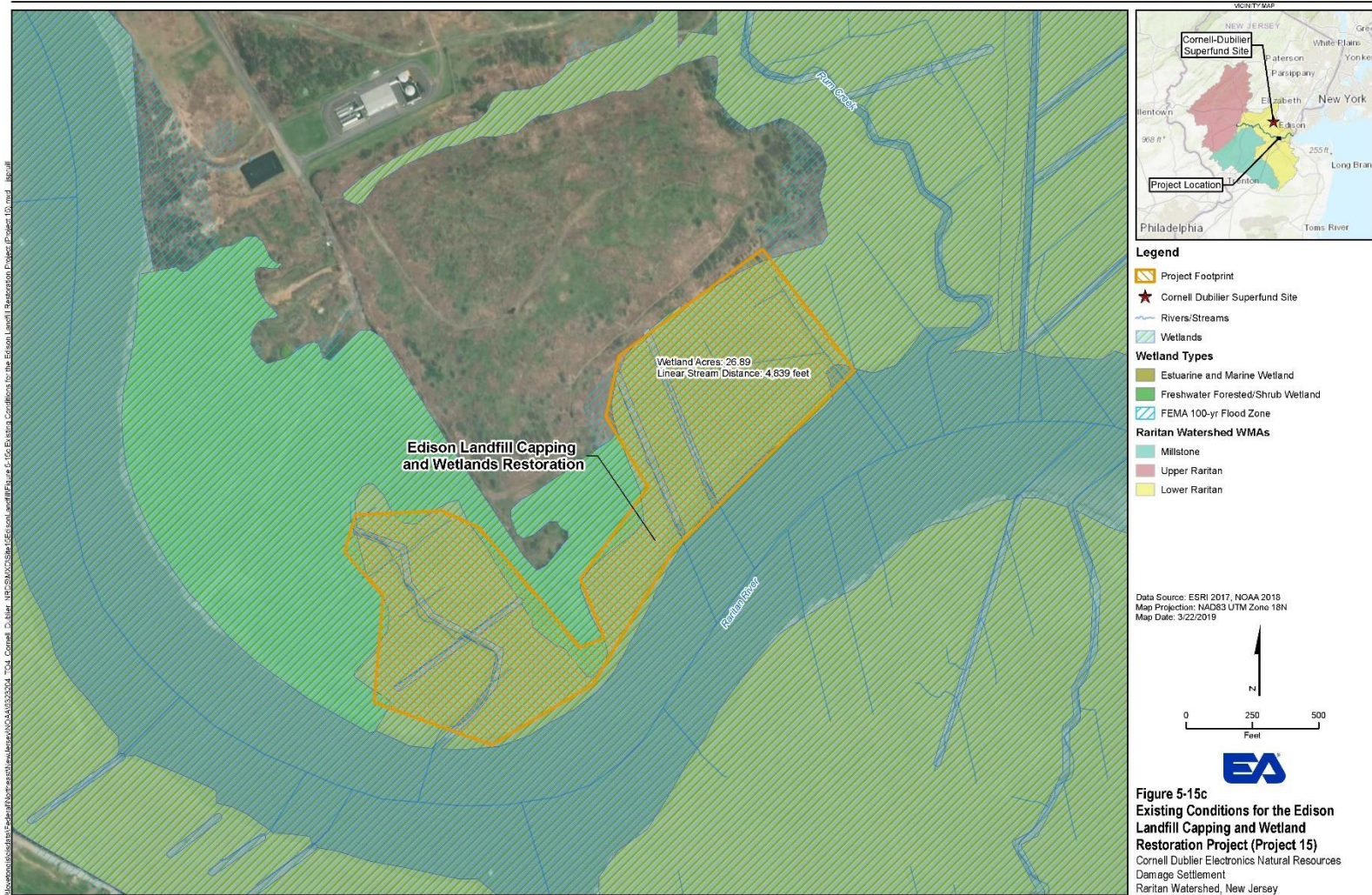
This project has potential risks/infeasibilities regarding site control/access, engineering design and permitting, and cost to complete. Due to the industrialized nature of the project area, it is possible that the lands to be restored contain contaminants consistent with those present throughout the lower watershed. As such, the project may involve a remedial challenge that affect project costs. It should be noted that the stakeholder did not provide an estimated cost for this project. In past years, the type of wetland enhancement included in this project has been largely successful in establishing native wetland vegetation at other nearby sites, though often accompanied by persistent contamination. Decisions controlling the use, capping and closure of landfills is subject to the regulatory authority of the NJDEP.

5.15.7 Resource Materials

No additional resource materials were available for this project.







5.16 NORTH BRANCH CORRIDOR RIPARIAN BUFFER RESTORATION (PROJECT 16)

5.16.1 Project Stakeholder(s)

The North Branch Corridor Riparian Buffer Restoration project was proposed by Raritan Headwaters, a regional nonprofit environmental organization with a proven track record of successful restoration of forested stream buffers in the Upper Raritan River Watershed. There has been no action on the project to date.

5.16.2 Project Location and Background

The North Branch Corridor Riparian Buffer Restoration (Project 16) is a proposed forested riparian buffer restoration project along the North Branch of the Raritan River, in the Upper Raritan River Watershed, one of the three major basins in the Raritan River Watershed. The project would span Somerset, Morris, and Hunterdon counties in New Jersey. Along the streams of focus there are 17 New Jersey Ambient Biomonitoring Network sites, one USGS stream gauge, four major dams, and three Fish IBI sampling sites.

Raritan Headwaters has conducted a recent trend analysis of data collected from the North Branch and its tributaries including Black River, Chambers Brook, Mine Brook, Peapack Brook, and Rockaway Creek, and found that there has been a decline in water quality over time. The main causes of impairment include nonpoint-source pollution, increased impervious ground cover with increased development, and the decline of forested stream buffers. The nonprofit encourages green infrastructure and reducing nonpoint-source pollution through their other programs and the State requires between 150-ft and 300-ft stream buffers depending on the region. A recent GIS analysis of river buffers show that the State-required buffers are sometimes not present or inadequate due to insufficient and deteriorating vegetative cover, which may at times be found along lengthy reaches of the river. The streams in this region provide drinking water to 1.5 million people in New Jersey; therefore, high water quality is important for the health of the citizens and the economy as well as the natural ecology of the area.

5.16.3 Proposed Restoration Action

The proposed action is a **riparian** project to **restore** riparian buffer habitat by planting 10,000 native trees and shrubs in partnership with public landowners over 5 years. The project will include monitoring to determine the effectiveness of riparian buffers on water quality. Specific project components would include:

- Establishing 10,000 native trees and shrubs to stream buffer areas within the watershed over 5 years;
- Removing invasive vegetation along stream buffer areas; and
- Monitoring for water quality including benthic macroinvertebrate and fish communities before and after restoration to determine the effect of stream buffer plantings on restoring water quality.

5.16.4 Site Conditions

The land within the project site is comprised of both public and private parcels in Somerset, Morris, and Hunterdon counties in New Jersey (Figure 5-16a). Land consists of mostly agricultural, forested, and residential land uses.

Implementation of this project would benefit numerous wildlife species in the stream and surrounding areas; specific target species identified by the project proponent are presented in Table 5-16a and include the Wood Turtle (*Glyptemys insculpta*) and Longtail Salamander (*Eurycea longicauda*). An online review using the USFWS IPaC project review tool identified one plant and two bat species listed as federally threatened or endangered, as being potentially present within the project site (Table 5-16b). No USFWS critical habitats are present within the project area.

Table 5-16a Target Species for the North Branch Corridor Riparian Buffer Restoration Project

Species Name	Type	Federal/State Listed Status
Wood Turtle (<i>Glyptemys insculpta</i>)	Reptile	Threatened – State
Longtail Salamander (<i>Eurycea longicauda</i>)	Amphibian	Threatened – State

Table 5-16b Listed Status Species Potentially Present at the North Branch Corridor Riparian Buffer Restoration Project Site

Species Name	Type	Federal/State Listed Status
Indiana Bat (<i>Myotis sodalist</i>)	Mammal	Endangered – Federal
Northern Long-Eared Bat (<i>Myotis septentrionalis</i>)	Mammal	Threatened – Federal
Small Whorled Pogonia (<i>Isotria medeoloides</i>)	Flowering plant	Threatened – Federal

5.16.5 Natural Resource and Human Use Benefits

Implementation of the North Branch Corridor Riparian Buffer Restoration project would result in restored vegetated riparian stream buffers throughout the North Branch of the Raritan River Watershed (Table 5-16c).

Table 5-16c Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Vegetated Riparian Stream Buffer	To Be Determined	Improved water quality, decreased water temperature by shading streams, improved habitat, stabilized stream banks, slowed flood waters

Vegetated floodplains help to remove excess nutrients, sediment, and other nonpoint source pollutants. They also increase water retention in the nearby areas, absorbing and slowing flood waters. Shade provided by riparian plant canopy cover would result in a decreased stream water temperature, which would be beneficial to fish such as Brook Trout (*Salvelinus fontinalis*) and their commonly fed-on insects would have a better chance at survival in these waters. Vegetated riparian zones also provide habitat for a variety of species. It is likely that the overall water

quality would improve. This would benefit wildlife as well as the people of New Jersey who get their drinking water from these streams.

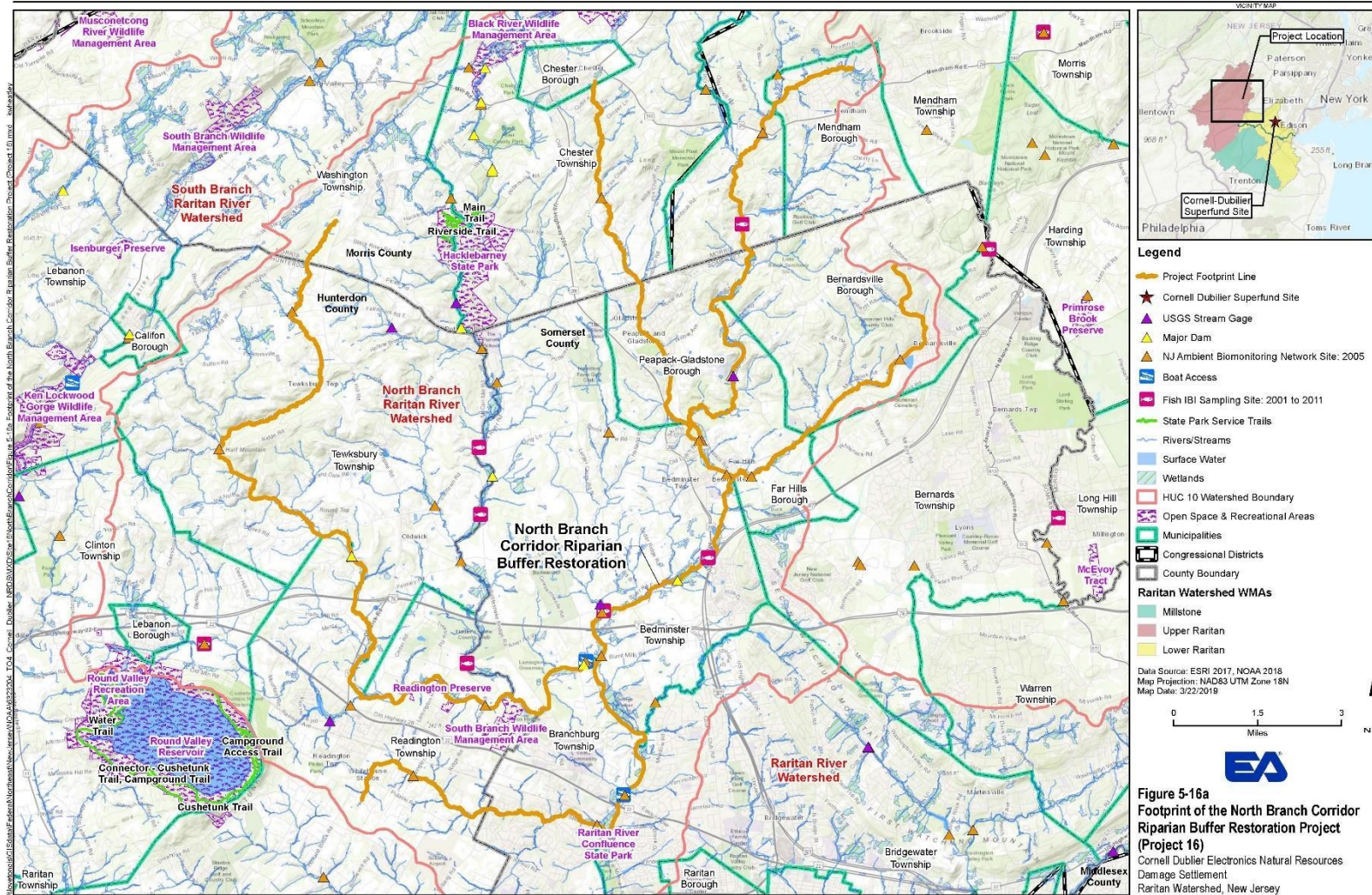
Intensive monitoring and analysis by Raritan Headwaters will also provide data on the effectiveness of stream buffer plantings on improving water quality, information which is important for future potential projects.

5.16.6 Project Risks and Uncertainties

This project has potential risks/infeasibilities associated with engineering design and biological challenges presented by the eradication of invasive vines along the buffer zones. The stakeholder provided an estimated cost of \$400,000 to complete this project and stated that they currently do not have any available funds. The stakeholder did not provide information regarding potential issues with site access and the need for landowner permission.

5.16.7 Resource Materials

No other resource materials were available for this project.



5.17 TRASH TRAP INSTALLATION ON THE LOWER RARITAN RIVER (PROJECT 17)

5.17.1 Project Stakeholder(s)

The Trash Trap Installation on the Lower Raritan River project was proposed by the Lower Raritan Watershed Partnership and may be supported by the Association of New Jersey Environmental Commission, Central Jersey Stream Team, Lawrence Brook Watershed Partnership, South River Green Team, Friends of Mile Run Brook, and New Brunswick Environmental Commission. To date, no action has been taken for this project.

5.17.2 Project Location and Background

The Trash Trap Installation on the Lower Raritan River project would span from Cuckels Brook at State Route 287 to the mouth of the Raritan River at Perth Amboy. This project area includes portions of South Bound Brook Borough, Highland Park Borough, Sayerville Borough, Perth Amboy, and South Amboy, New Jersey (Figure 5-17a). The Trash Trap Installation on the Lower Raritan River project would be located southwest of the CDE site within the Lower Raritan River Watershed (Figure 5-17a). Two New Jersey Ambient Biomonitoring Network sites are within the project area. A USGS stream gauge is located in the most upstream portion of the project area. In addition, approximately ten New Jersey Ambient Biomonitoring Network sites and four Fish IBI Sampling Sites are found in areas surrounding the project area (Figure 5-17a).

Many forms of pollution impact the overall health of the Lower Raritan Watershed and the Raritan River. Trash is the most visible form of pollution in many of the urban waterways including Green Brook, Mile Run Brook, Mill Brook, and South River. Trash within these tributaries is often observed entering the Raritan River. Trash, plastic, and other stormwater runoff debris impact wildlife, human health, and the environment. Plastics break down and leach toxins, posing a threat to both marine and human life.

To reduce the amount of pollutants entering the Raritan River, the Lower Raritan Watershed Partnership and other partners organize more than 12 stream cleanups each year to remove trash including plastics and other floatables within the Raritan River tributaries and floodplain. Cleanup efforts are ongoing in this area. Year after year, and sometimes multiple times per year, volunteers return to these sites only to find that more debris has gathered in these areas.

5.17.3 Proposed Restoration Action

The proposed action is an **in-stream** action to **enhance** debris reduction in the Raritan River. Specific project components include the following:

- Installing three to five trash traps within stream/tributary outfalls and connections to the Raritan River.

- The locations of the trash traps have not been identified and evaluated; however, traps would be placed at outfalls in close proximity to roadways, allowing easy access for maintenance.
- The trash traps would be end-of-outfall nets to capture litter and organic materials before they enter the Raritan River, reducing the amount of litter, debris, phosphorus, and nitrogen in water.
- The traps would not be designed to catch large branches and logs.
- The outfall nets would be designed based on the catchment area and through analysis of the stormwater pipe and catch basin layout.
- Outfall nets would be anchored to existing outlet pipes. Implementation of trash traps would facilitate easier point removal of debris from a specific location.
- The proposed project would also include designing a study with different trash reduction strategies to determine what type of removal is most effective.
 - Trash reduction strategies within the catchment areas would include catch basin blockers, more frequent street sweeping, community cleanups, and education about litter.
- Engaging the public in helping to maintain these systems in their community.
- Implementing a volunteer trash removal program that includes training on how to measure and report trash collected by volume for a period of 3 to 5 years.

After the amount of litter collected at each site is assessed and reported, specific trash sources would be identified. The ability to pin-point where trash is coming from would increase community awareness of stormwater runoff into the waterways.

5.17.4 Site Conditions

The proposed project area includes 18 miles of the Raritan River and tributaries. Approximately 5,002 acres of wetlands are located within the project area. Wetlands in the upstream portion of the project area are mostly described as freshwater emergent wetlands and freshwater forested/shrub wetlands. The downstream portion of the project area is comprised of mostly estuarine and marine wetlands (Figure 5-17b). The majority of the project area adjacent to the Raritan River occurs within the 100-year floodplain (Figure 5-17b).

Wildlife in the Lower Raritan River Watershed is characterized by a large variety of mammals, birds, and fish. Mammals including White-Tailed Deer (*Odocoileus virginianus*), Black Bear (*Ursus americanus*), and Coyote (*Canis latrans*) can be found within the Lower Raritan River Watershed. Smaller mammals such as Raccoon (*Procyon lotor*), Skunk (*Mephitis mephitis*), and Eastern Gray Squirrel (*Sciurus carolinensis*) are also observed (Lower Raritan River Partnership 2019). Common birds include American oystercatcher (*Haematopus palliatus*), Bald Eagle (*Haliaeetus leucocephalus*), Peregrine Falcon (*Falco peregrinus*), and a wide range of gulls (Rutgers University 2018). Common fish species within the Lower Raritan River include Largemouth Bass (*Micropterus salmoides*), Smallmouth Bass (*Micropterus dolomieu*), carp (Cyprinidae), Yellow Perch (*Perca flavescens*), sunfish (*Lepomis* spp.), catfish (Siluriformes), and American Eel (*Anguilla rostrata*) (Rutgers University 2018). Amphibian species are also common in the wetland areas throughout the Lower Raritan River Watershed.

An online review using the USFWS IPaC project review tool identified one bird species listed as federally threatened or endangered, as being potentially present within the project site (Table 5-17b). No USFWS critical habitats are present within the project area.

Table 5-17a Listed Status Species Potentially Present at the Trash Trap Project Site

Species Name	Type	Federal/State Listed Status
Bald eagle (<i>Haliaeetus leucocephalus</i>)	Bird	State Threatened

5.17.5 Natural Resource and Human Use Benefits

Implementation of the Lower Raritan River Trash Trap Installation project would enhance a total of 18 miles of the Raritan River from the initial trash trap installation at the outfall near Cuckels Brook at State Route 287 to the mouth of the Raritan River at Perth Amboy. A total of 3,142 total wetland acres would be enhanced with 2,915 of these acres within the 100-year floodplain. The removal of trash from the Raritan River would reduce the amount of contaminants entering the waterways and improve the overall water quality. Improvement of water quality would also benefit the native flora and fauna of the area. Reduction of plastic debris would create beneficial effects to the overall health of wildlife through the reduction of ingestion and also the reduction of exposure to contaminants.

Table 5-17b Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit(s) Gained
Riverine	18 miles	Improved water quality and habitat for wildlife
Wetland	3,142 acres	Improved water quality and habitat for wildlife.

In addition to the positive benefits to water quality and flora and fauna, the implementation of trash traps throughout the Lower Raritan Watershed would benefit the aesthetics of the area. In addition, reports on the amount of trash removed from the various locations would make the general public more aware of litter within the local neighborhoods. This project would also enhance public perception and usability of recreational areas along the Raritan River.

5.17.6 Project Risks and Uncertainties

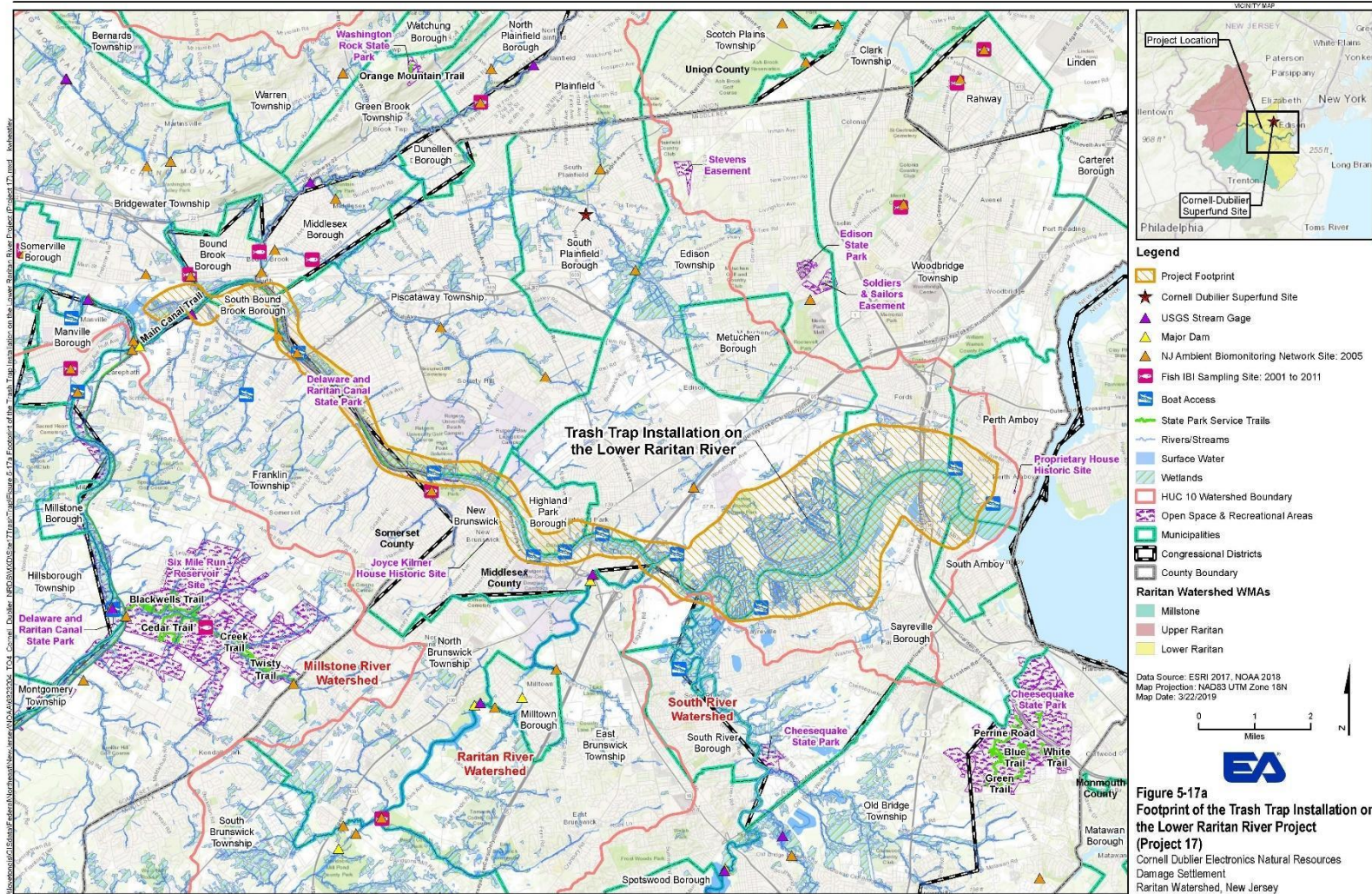
No specific project risks or infeasibilities were identified by the stakeholder; however, it is noted that this project may receive financial and in-kind (volunteer) support from NGO(s). The stakeholder did not provide any cost estimate or statement of available funds for the project.

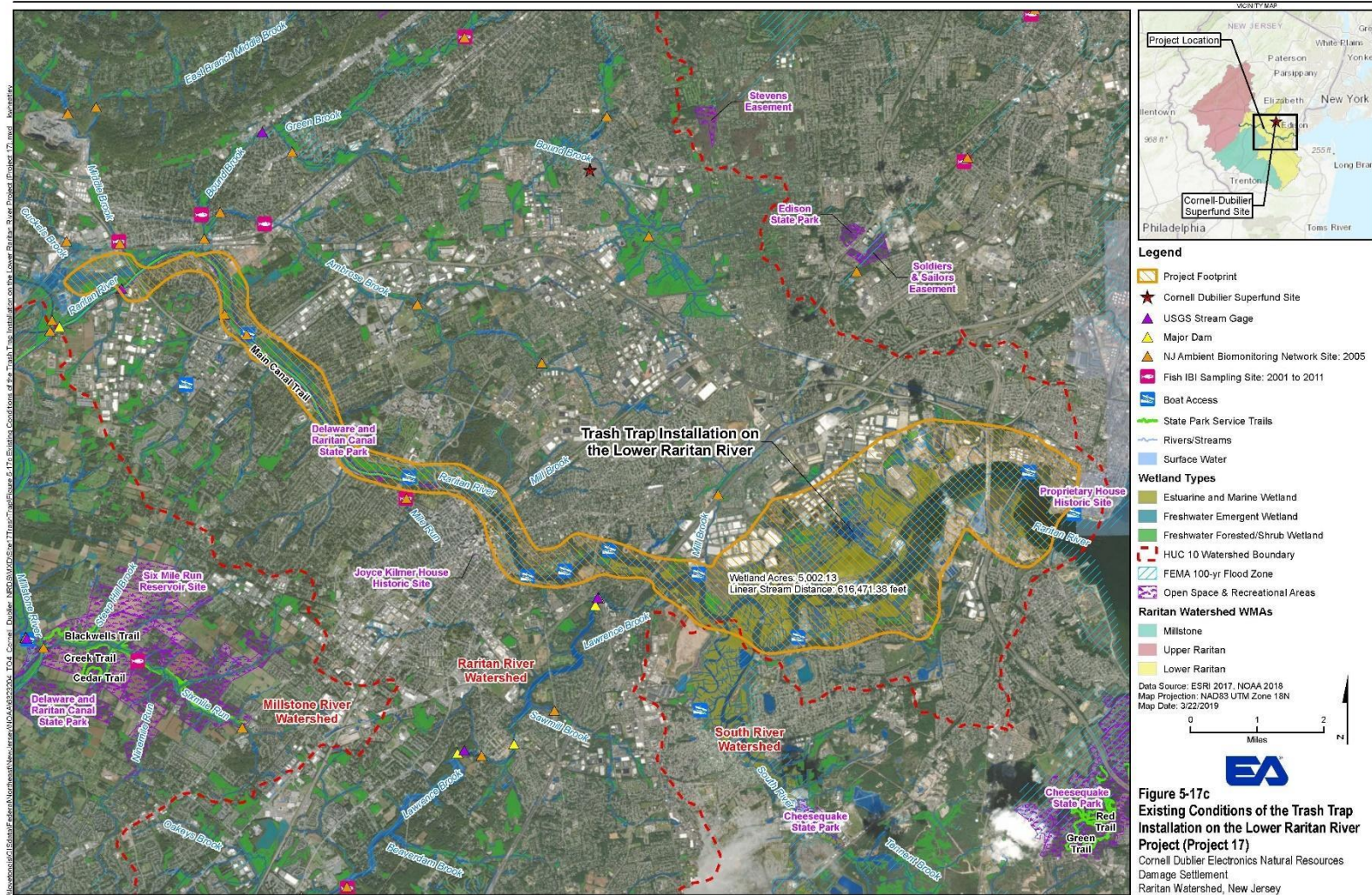
5.17.7 Resource Materials

Resources used in addition to those described in Section 5.1 include:

Rutgers University. 2008. *Raritan River Initiatives, The Lower Raritan – WMA09*.
<http://raritan.rutgers.edu/the-lower-raritan-wma09/>. Accessed on 12 March 2019.

Lower Raritan River Partnership. 2019. *Land Cover + Habitat*.
<http://lowerraritanwatershed.org/land-cover-habitat/>. Accessed on 12 March 2019.





5.18 BRIDGE OVER THE DELAWARE AND RARITAN (D&R) CANAL SPILLWAY (PROJECT 18)

5.18.1 Project Stakeholder(s)

The Bridge over the Delaware and Raritan (D&R) Canal Spillway project was proposed by the Lower Raritan Watershed Partnership and may be supported by the D&R Canal State Park, D&R Canal Watch, Rutgers University Planning, New Jersey Water Supply Authority, Sustainable Raritan River Initiative, the City of New Brunswick, and Middlesex County Office of Planning. To date, no action has been taken for this project.

5.18.2 Project Location and Background

The D&R Canal State Park is a 70-mile linear park spanning from Trenton to New Brunswick, New Jersey. The project area is located on the Raritan River in New Brunswick, approximately 40 miles southwest of New York City (Figure 5-18a). The Bridge over the D&R Canal Spillway project would be located south of CDE within the Lower Raritan River Watershed (Figure 5-18a). A New Jersey Ambient Biomonitoring Network site and Fish IBI sampling site are located approximately 0.5 mile southwest of the project area on Mile Run. A boating access ramp is located just upstream of the project site (Figure 5-18a).

The D&R Canal State Park is one of New Jersey's most significant historic and recreational resources as it provides over 60 miles of hiking and biking trails as well as opportunities for canoe and kayak access to the Raritan River. However, a 200-ft spillway separates residents of the City of New Brunswick from safe access to the recreational offerings of this greenway. Likewise, 200 ft. separates users of the D&R Canal coming from the opposite direction from easy access to the riverside Boyd Park, historic D&R Canal locks, and New Brunswick Landing. The existing disconnected path, referred to as “the trench” located north of Buccleuch Park, is approximately 7,000 ft. long and an average of 30 ft. wide (approximately 210,000 square ft. or 4.8 acres).

5.18.3 Proposed Restoration Action

The proposed action is a **recreational** project that would **increase access** through construction of a prefabricated steel bridge over the 200-ft spillway and water intake. The proposed bridge would be 200 ft. long and 10 ft. wide and would be installed by crane onto concrete pilings and abutments. The pilings and abutments would be constructed so that flow of water across the spillway is not impeded. The proposed action would also include rehabilitation and prevention of erosion of the river bank that flanks the spillway.

5.18.4 Site Conditions

The land within the project site is comprised of two public parcels of land regulated by NJDEP (Figure 5-18b).

The proposed project area includes the D&R Canal State Park and the spillway on the Raritan River. No freshwater emergent or forested/shrub wetlands occur within the immediate vicinity of the project area (Figure 5-18c). The project is entirely located within the 100-year floodplain (Figure 5-18c).

5.18.5 Natural Resource and Human Use Benefits

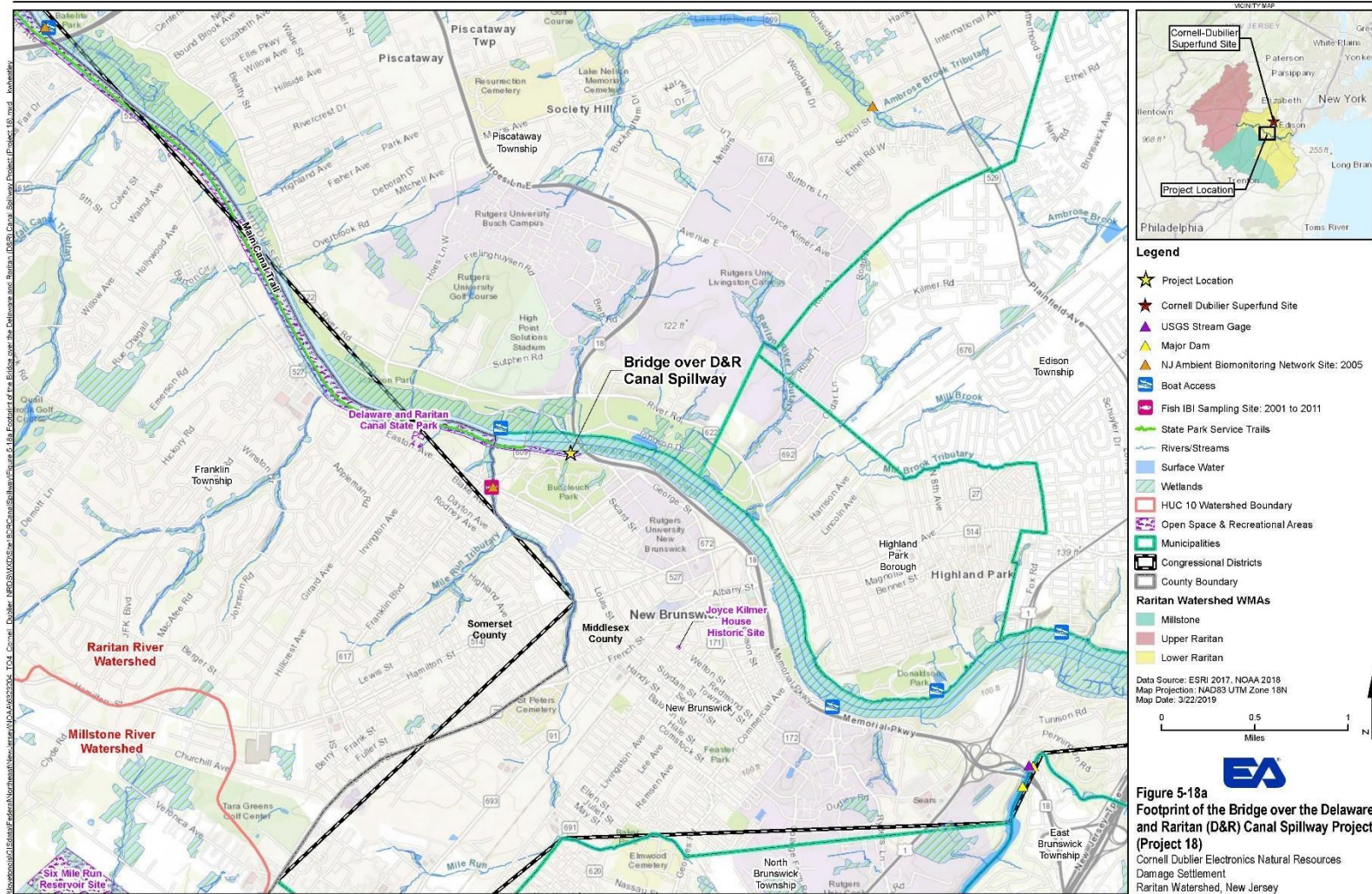
The construction of the steel pedestrian and biking bridge would improve access to the Raritan River waterfront in the most densely populated part of the Raritan River Watershed. It is also a critically important missing link to the regional network of trails, providing connection to the Rutgers University bicycle trail network and East Coast Greenway. If completed, the connection would also serve to extend the 70-mile long D&R Canal State Park into the City of New Brunswick, effectively restoring the historic extent of the original towpath which was severed with the construction of the Route 18 highway and other infrastructure improvements. The proposed project complements other Raritan River initiatives being considered by other agencies and institutions in the area, including waterfront access projects proposed in the Rutgers University 2030 Physical Master Plan. Improved access to the Raritan River waterfront afforded by this project will significantly increase access and support recreational, educational, and research opportunities for the community. In addition, if implemented this project would have significant positive public health and recreation impacts on the predominantly low socio-economic status population of New Brunswick.

5.18.6 Project Risks and Uncertainties

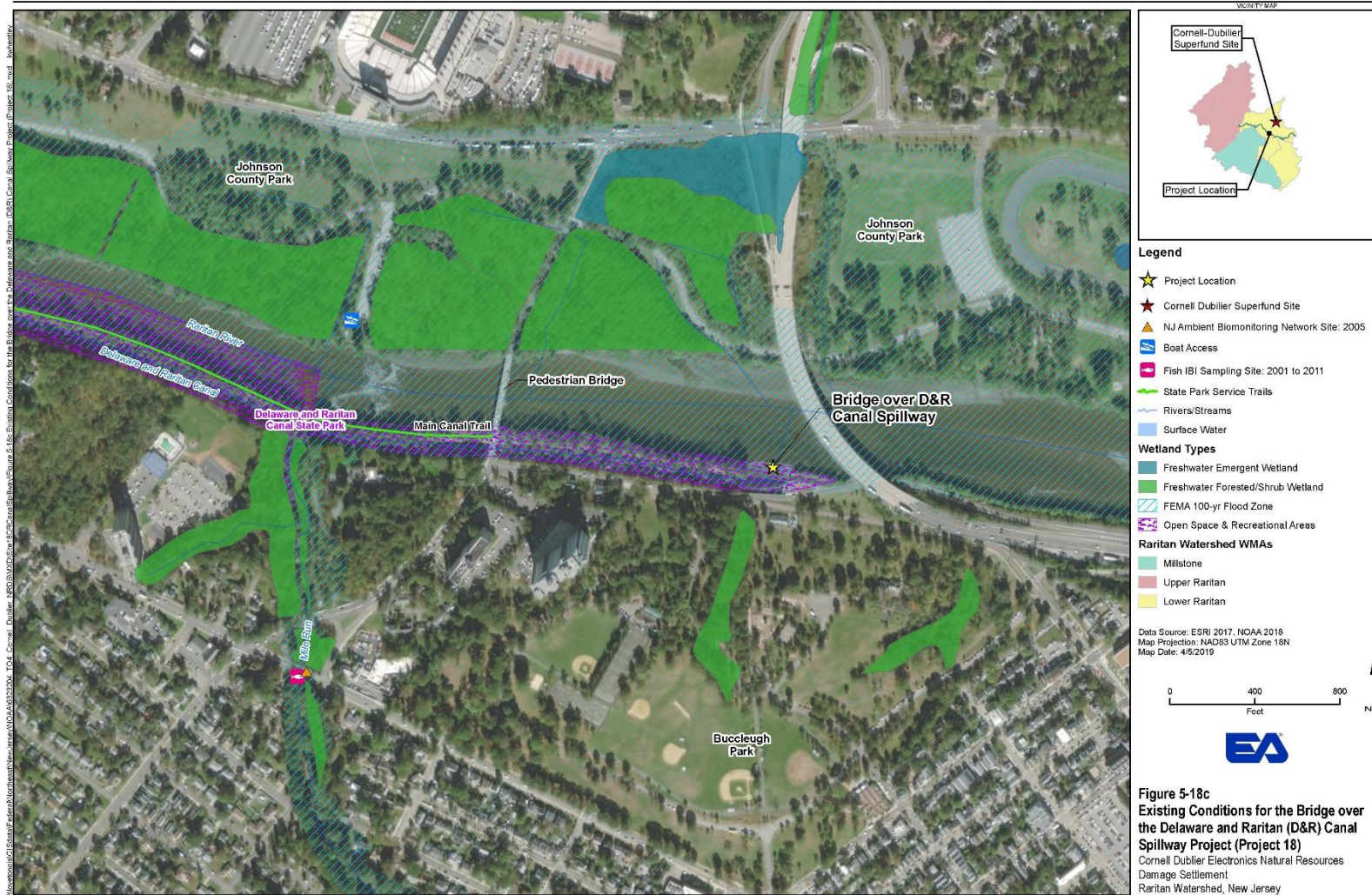
Technical and engineering challenges that may be encountered include alignment of pier and piling structures so as not to impede flow at the spillway or risk undermining the integrity and stability of the D&R canal spillway and wingwall structures. The stakeholder estimates to be \$2,000,000 for completion of this project; actual costs are uncertain. According to the stakeholder, there are currently no available funds allocated to this project.

5.18.7 Resource Materials

No additional resource materials were available for this project.







5.19 MANALAPAN LAKE RIPARIAN RESTORATION (PROJECT 19)

5.19.1 Project Stakeholder(s)

The Manalapan Lake Riparian Restoration project was proposed by the Rutgers Cooperative Extension of Middlesex County and may be supported by the Middlesex County Office of Parks and Recreation, Princeton Hydro, and Middlesex County Office of Planning. This project is currently in the design phase.

5.19.2 Project Location and Background

Manalapan Brook, a tributary of the Raritan River, is 22 miles in length. Originating in Monmouth County, the Manalapan Brook drains north to join with the Matchaponix Brook at Spotswood to form the South River into Middlesex County where it joins the Raritan River. Manalapan Lake is the largest impoundment (48 acres) on Manalapan Brook and is located in Thompson County Park in Middlesex County, New Jersey, approximately 45 miles southwest of New York City (Figure 5-19a). The Manalapan Lake Riparian Restoration Project would be located south of CDE within the Lower Raritan River Watershed (Figure 5-19a).

A total phosphorus Total Maximum Daily Load was established by NJDEP for Manalapan Lake (Monroe Township, Middlesex County, New Jersey). In 2010, the Manalapan Brook Watershed Restoration and Protection Plan was completed and identifies specific locations for restoration projects that should be implemented to reduce the existing total suspended solids loads. The completed Plan has since been used to obtain funds through the SFY2013 NJDEP 319-grant program (and more recently the SFY2017 program). Guided by the Plan, project partners have been successful in restoring over 600 ft. of riparian shoreline buffer, a parking lot biofiltration system, and two floating wetland islands at Manalapan Lake. In addition, a stormwater detention basin in the township of Manalapan was retrofitted into a wetland Best Management Practice and additional funding has been awarded to continue similar projects throughout the watershed. Education and outreach videos have been developed to inform the public about these projects.

In 2016 a 600-ft-long, 15- to 20-ft-wide riparian buffer was installed along the eroding southern edge of Manalapan Lake to reduce sediment loading, provide erosion control, and deter use by Canada Geese.

5.19.3 Proposed Restoration Action

The proposed action is a **riparian** project to **restore** buffer areas along Manalapan Lake. Due to the success of 2016 Manalapan Lake Riparian Buffer project, the proposed action includes the expansion of another riparian buffer. The Manalapan Lake Shoreline Stabilization project would be located along the southern shoreline of Manalapan Lake and would be focused on restoring 600 linear ft. of linear shoreline. Specific project components would include:

- Re-grading and installing erosion control blankets, coir logs, and native vegetation;

- Creation of a vegetated buffer to dissipate and resist the wind-driven wave action along the shoreline, in addition to deterring the Canada geese, which frequent the lake; and
- Planting of aquatic vegetation to reduce the wind-driven wave energy associated with the long fetch of Manalapan Lake.

The objective of these design measures is to reduce total suspended solids loading originating from the continued erosion and degradation of the Manalapan Lake shoreline. The persistent erosion is a result of numerous factors including wind-driven wave action erosion and exposed soil due to extensive Canada geese herbivory of the vegetation.

The implementation of this project would require permitting due to its riparian location including the 100-year floodplain, wetlands, and the local Soil Conservation District. There is a potential for timing restrictions that would require that work not be performed between 1 May and 30 June to restrict impacts on general gamefish. No lake lowering would be required for this project.

5.19.4 Site Conditions

The land within the project site is comprised of one public parcel of land regulated by the Middlesex County Courthouse (Figure 5-19b).

The proposed project area includes approximately 600 linear ft. of riparian area along the southern shore of Manalapan Lake. Much of this area is currently denuded of vegetation and has exposed soil. No freshwater emergent or forested/shrub wetlands occur within the immediate vicinity of the project area (Figure 5-19c). The entire project would occur within the 100-year floodplain (Figure 5-19c). There are no specific species within the project footprint that are target species for the project, other than typical wetland plants that are commonly found in emergent habitat, as well as common submerged aquatic vegetation and floodplain plants. An online review using the USFWS IPaC tool was performed for the project site; a listed flowering plant, one mammal, and one reptile were found to be potentially present in the project area (Table 5-19a).

Table 5-19a Listed Status Species Potentially Present at the Manalapan Lake Riparian Restoration Project Site

Species Name	Type	Federal/State Listed Status
Swamp Pink (<i>Helonias bullata</i>)	Flowering Plant	Threatened – Federal
Northern Long-Eared Bat (<i>Myotis septentrionalis</i>)	Mammal	Threatened – Federal
Bog Turtle (<i>Clemmys muhlenbergii</i>)	Reptile	Threatened – Federal

5.19.5 Natural Resource and Human Use Benefits

A total of 0.52 acre of wetland and riparian habitat would be enhanced from the restoration. Plant species that will benefit include wetland plants that typically populate the littoral zone of a lake, floodplain, or emergent wetland habitat including pickerel weed (*Pontederia cordata*), broadleaf arrowhead (*Sagittaria latifolia*), northern blue flag (*Iris versicolor*), green bulrush (*Schoenoplectus atrovirens*), softstem bulrush (*Schoenoplectus tabernaemontani*), crimsoneyed

rosemallow (*Hibiscus moscheutos*), river birch (*Betula nigra*), silky dogwood (*Cornus amomum*), and red chokeberry (*Photinia pyrifolia*). The restoration of the riparian area would improve habitat for many native birds, mammals, reptiles, and amphibians. In addition, a number of state endangered and threatened species will benefit from this project including the American bittern (*Botaurus lentiginosus*) and Pied-billed grebe (*Podilymbus podiceps*), which favor emergent wetlands, and Bald Eagle (*Haliaeetus leucocephalus*).

Table 5-19b Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Riparian Buffer	0.26 acre	Improved water quality and habitat for wildlife
Wetland	0.26 acre	Improved water quality and habitat for wildlife. Increase in native wetland vegetation.

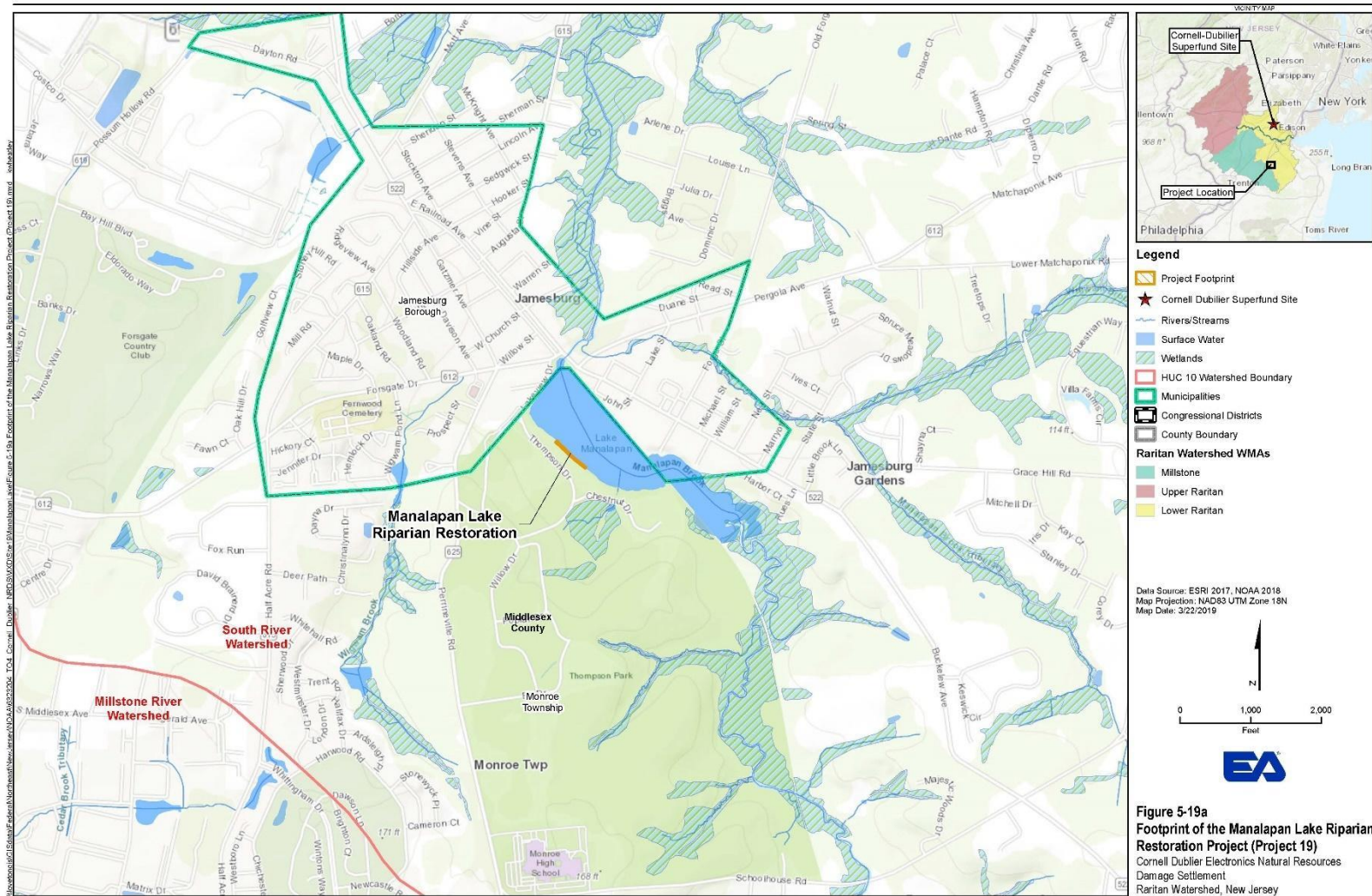
Along with stabilizing the shoreline and preventing further erosion, the project will also provide ecological, recreational, and aesthetic benefits to Thompson Park.

5.19.6 Project Risks and Uncertainties

This project has potential risks/infeasibilities associated with typical technical/engineering/biological challenges related to long-term stability and success of riparian restoration projects. The original cause for loss of the riparian buffer would need to be determined and addressed, which includes limiting the mowing regime of the area. Grazing by herbivores would have to be controlled by measures included in the design. Funds for long-term maintenance would also be of benefit. The stakeholder provided an estimated cost of \$57,200 for completion of this project and stated that they currently do not have any available funds.

5.19.7 Resource Materials

No additional resource materials were available for this project.







5.20 BEISLER LAKE DAM ON SPRUCE RUN CREEK (PROJECT 20)

5.20.1 Project Stakeholder(s)

The Beisler Lake Dam on Spruce Run Creek project was proposed by Cross Roads Camp and Retreat Center by the Evangelical Lutheran Church in America – New Jersey Synod and may be implemented in partnership with Trout Unlimited’s Ridge Valley Chapter and the Raritan Headwaters Association. The final design for this project is completed, and work has begun. Additional money is being requested to complete the dam removal.

5.20.2 Project Location and Background

The Beisler Lake Dam Project on Spruce Run Creek (Project 20) is a proposed stream restoration and remnant dam removal project in Lebanon Township, Hunterdon County, New Jersey. The site is on Spruce Run Creek, which flows south eventually draining into the Spruce Run Reservoir, which supplies drinking water to over 3 million New Jersey residents. The stream is located within the Lower Raritan River Watershed, one of the three major river basins in the Raritan River Watershed (Figure 5-20a).

Beisler Lake was originally created to be a recreational swimming and boating lake. In 1971 Beisler Lake Dam on Spruce Run Creek was built creating the lake that covered 6.8 acres and impounded 960 linear feet of stream. The dam measured 630 ft. long and 17.1 ft. high and was the only dam on Spruce Run Creek from the headwaters to the Spruce Run Reservoir. As requested by NJDEP, a dam failure analysis was completed in 2015, designating the dam as Class I (High Hazard Potential). This required the property owner to either reconstruct the dam to meet minimum hazard requirements or remove the dam altogether. The high cost for reconstruction caused the property owner to choose to remove the dam; however, remnant pieces of the dam remain.

Currently, the lake water has been drained and the lake bed has been re-vegetated, but the stream that flows through the former lake bed is in need of restoration, and the remnant pieces of the dam will also need to be fully removed to complete the project.

The section of river just below Beisler Lake Dam is considered habitat for native Brook Trout (*Salvelinus fontinalis*), but the dam has disconnected upstream and downstream populations. Also, since it is the only dam upstream of the reservoir, it has an influence on water quality. The water was warmed to high temperatures in the impoundment behind the dam during hot summer months and large flocks of Canada geese (*Branta canadensis*) impacted water quality significantly.

5.20.3 Proposed Restoration Action

The proposed action is a **stream restoration** and **dam removal** project that would **enhance** a stream channel that flows through the former lake bed. Specific project components would include:

- Draining of Beisler Lake (completed);
- Planting of the lake bed (completed);
- Removal of the remaining sections of Lake Beisler dam;
- Stream restoration of the stream that flows through the former lake bed; and
- Creation of four vernal pools within the former lake bed.

5.20.4 Site Conditions

The land within the project site is comprised of one private parcel owned by the New Jersey Synod Evangelical Lutheran Church (Figure 5-20b).

The creek is surrounded by freshwater forested/shrub wetlands and the surrounding land consists of a mix of agricultural, forested, and residential land (Figure 5-20c).

Implementation of this project would benefit numerous wildlife species; specific target species identified by the project proponent are presented in Table 5-20a and include fish, birds, reptiles, and one mammal. In addition, an online review using the USFWS IPaC project review tool identified one plant, two bat, and one turtle species listed as federally threatened or endangered species, as being potentially present within the project site (Table 5-20b). No USFWS critical habitats are present within the project area.

Table 5-20a Target Species for the Beisler Lake Dam Removal on Spruce Run Creek Project

Species Name	Type	Federal/State Listed Status
Brook Trout (<i>Salvelinus fontinalis</i>)	Fish	Species of Concern
Wood Turtle (<i>Glyptemys insculpta</i>)	Reptile	Threatened – State
Night Herons (<i>Nycticorax</i>)	Bird	Threatened – State
Northern Harrier Hawk (<i>Circus hudsonius cyaneus</i>)	Bird	Endangered – State
Eastern Box Turtle (<i>Terrapene carolina carolina</i>)	Reptile	Not Listed
Bobcat (<i>Lynx rufus</i>)	Mammal	Endangered – State
Bobolink (<i>Dolichonyx oryzivorus</i>)	Bird	Threatened – State
Upland Sandpiper (<i>Bartramia longicauda</i>)	Bird	Endangered – State

Table 5-20b Listed Status Species Potentially Present at the Beisler Lake Dam Removal on Spruce Run Creek Project Site

Species Name	Type	Federal/State Listed Status
Bog Turtle (<i>Clemmys muhlenbergii</i>)	Reptile	Threatened – Federal
Indiana Bat (<i>Myotis sodalist</i>)	Mammal	Endangered – Federal
Northern Long-Eared Bat (<i>Myotis septentrionalis</i>)	Mammal	Threatened – Federal
Small Whorled Pogonia (<i>Isotria medeoloides</i>)	Flowering Plant	Threatened – Federal

5.20.5 Natural Resource and Human Use Benefits

Implementation of the Beisler Lake Dam on Spruce Run Creek project would result in restoration and enhancement of 25.8 acres of land within the project site. Additionally, 1.5 stream miles would be enhanced (Table 5-20c).

Table 5-20c Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Wetland	3 acres	Improved hydrologic connectivity, improved water quality, provide habitat
Upland	8 acres	Provide habitat
Floodplain	6.8 acres	Provide habitat, increased capacity for water storage
Riparian buffer	8 acres	Provide habitat, shades stream decreasing water temperature
Stream	1.5 miles	Improved stream connectivity, improved water quality, increased fish passage, decreased water temperature

Restoration and enhancement of the stream and removal of the remnant pieces of the dam would improve stream connectivity, improve water quality, and increase fish passage. Removing standing water should discourage long-term stays from geese that were causing water quality issues in the past. This is important since the water flows directly to a downstream drinking water reservoir. Water temperature should decrease, increasing dissolved oxygen levels, creating more suitable habitat for oxygen-sensitive fish. Creation of the four vernal pools would improve hydrologic connectivity, improve the overall water quality, and provide additional habitat for wildlife including many species of amphibians. The overall improvements to the riparian buffer, uplands, and floodplain would provide habitat for wildlife and decrease water temperature by providing shade.

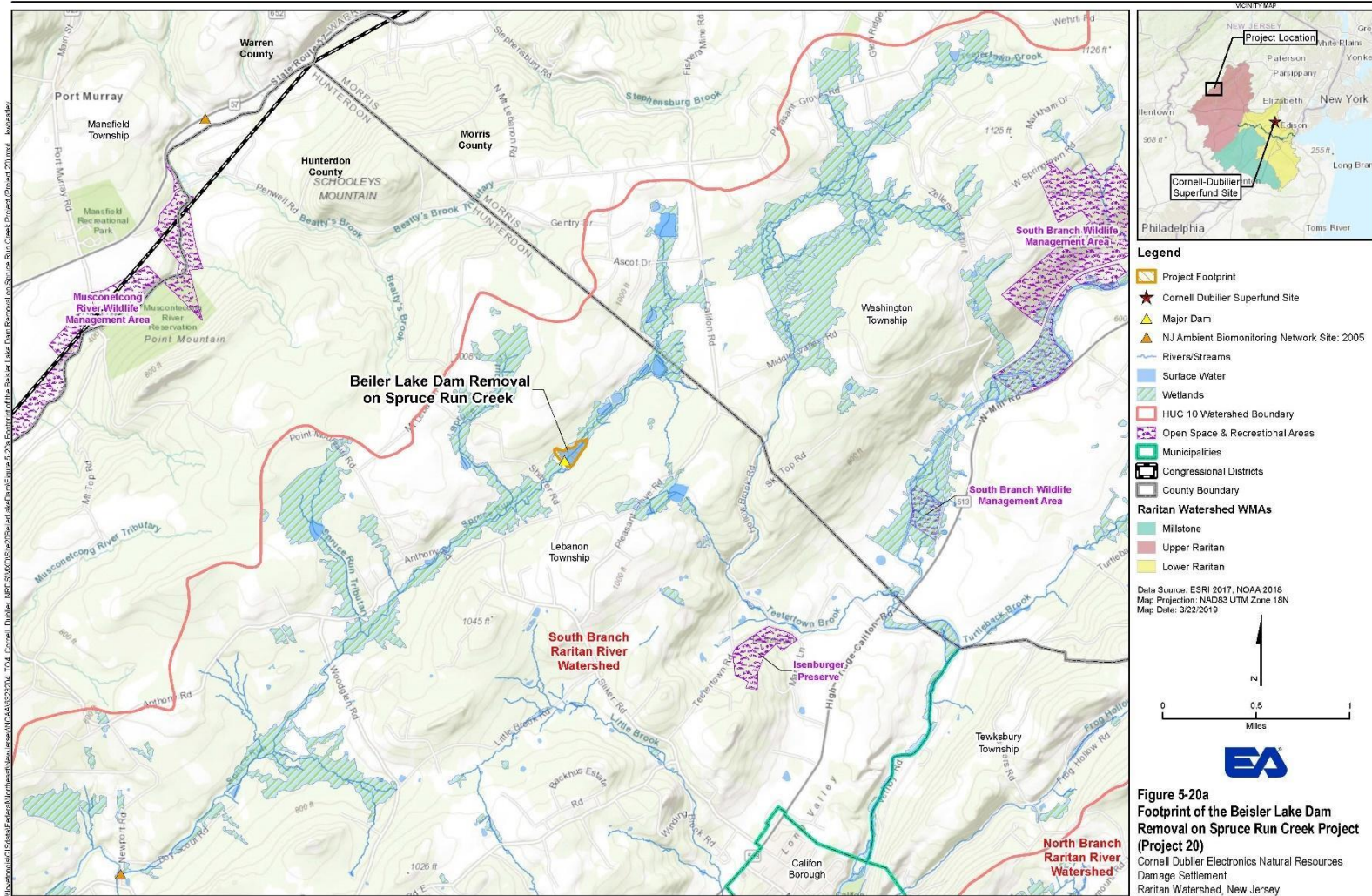
5.20.6 Project Risks and Uncertainties

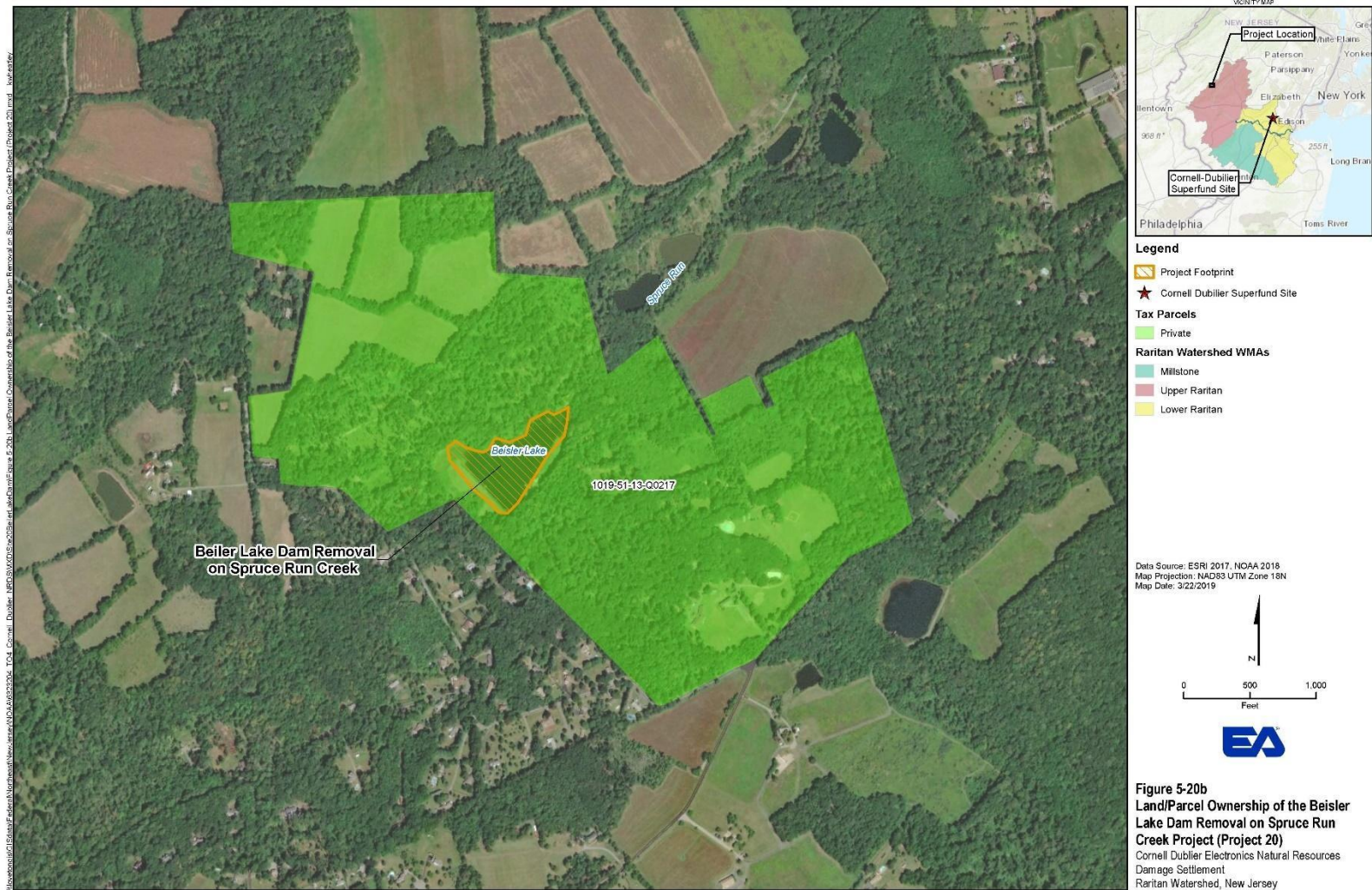
The stakeholder identified no specific risks or infeasibilities for this project. Several components of this project have already been completed; additional funding is needed to complete the remaining actions within a reasonable timeframe. The stakeholder stated that they currently have \$345,000 of the \$459,927 needed to complete this project. The stakeholder does not anticipate any permitting issues, as work has been completed with approval of the NJDEP Bureau of Dam Safety and Flood Control on elements of the project including the dam removal and stream restoration in the now drained lake bed. It is uncertain from the information gathered, however if the creation of four vernal pools require excavation of sediments within a State-regulated wetland, the project may require additional review under the state and federal permit process.

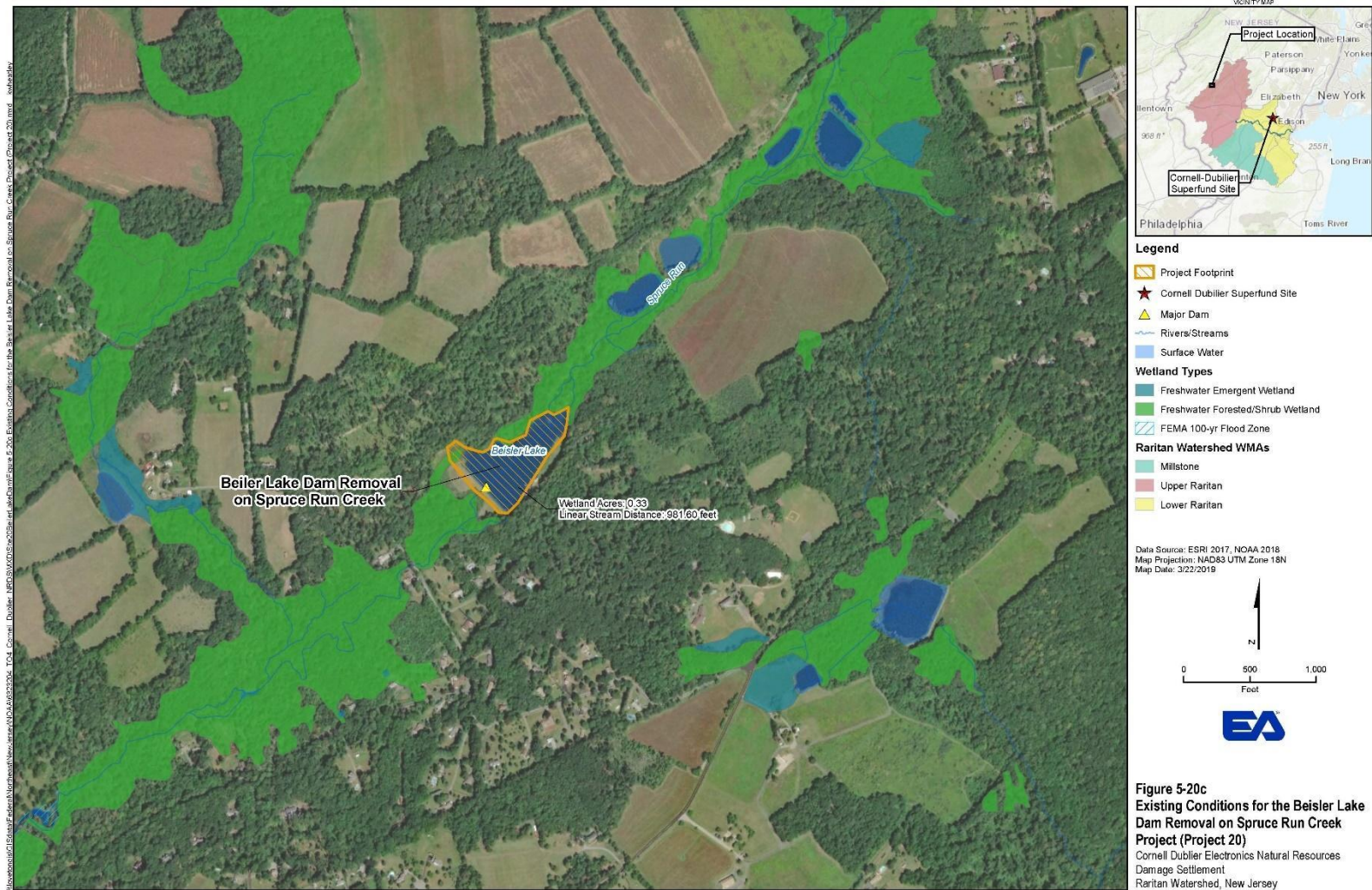
5.20.7 Resource Materials

Resources used in addition to those described in Section 5.1 include:

Beisler Lake Dam Removal and Channel Reconstruction Design Drawings and Project Description.







5.21 BURNT MILLS DAM REMOVAL (PROJECT 21)

5.21.1 Project Stakeholder(s)

The Burnt Mills Dam removal project was submitted by USFWS. The dam removal design was drafted by the USFWS R5 Fish Passage Engineer Team and the project may be implemented in partnership with the Natural Resources Conservation Service (NRCS) and the Raritan Headwaters Association. Additional project partners may include, Trout Unlimited, Somerset County in New Jersey, and the New Jersey Division of Fish and Wildlife. Project partners hope to start construction in summer 2019. USFWS and USDA-NRCS have begun applying for permits.

5.21.2 Project Location and Background

The Burnt Mills Dam Removal project (Project 21) is a proposed dam removal project located on the Lamington River, in Bedminster Township, Somerset County, New Jersey. The dam is in the Upper Raritan Watershed. The Lamington River flows generally north to south, until the most downstream part where it turns toward the northeast and then meets the North Branch Raritan River. The dam site is about 2,000 ft. upstream of this confluence. The Burnt Mills USGS gage station is approximately 330 feet downstream of the dam. There is a New Jersey Ambient Biomonitoring Network site just downstream of the dam removal site and a Fish IBI sampling site upstream along the Lamington River (Figure 5-21a).

The old mill dam was breached in the 1950s and has since caused significant amounts of erosion and sedimentation within the river and contributed to flooding of the nearby residences. The USFWS and USDA-NRCS are concerned that what is left of the dam may someday fail, threatening several state-listed threatened and endangered freshwater mussel species living downstream.

5.21.3 Proposed Restoration Action

The proposed action is a **dam removal** project to **protect and enhance** aquatic habitat, potentially reduce flooding on adjacent homeowner properties, stabilize extreme river bank erosion, and improve sediment transport and water quality. Specific project components would include:

- Remove the Burnt Mills Dam;
- Use a channel block to re-align the main river channel to reside along the bank-right;
- Widen the main channel to bankfull width;
- Close off the breached reach to create an oxbow channel;
- Alleviate severe bank erosion on bank-left;
- Lower the bank height of the small floodplain just upstream of the dam on bank-left; and
- Use plants, rock, and root wads to vegetate and stabilize soil.

5.21.4 Site Conditions

The land within the project site is owned by Somerset County, New Jersey (Figure 5-21b). The entirety of the project footprint is sited within the 100-year floodplain. Freshwater forested/shrub wetlands exist just downstream of the site, while surrounding land is fairly forested with a farm field to the southeast and residential areas to the north. Roads less than 200 ft. away exist to the north, east, and south of the site (Figure 5-21c).

Implementation of this project would benefit numerous wildlife species including state-listed mussels, resident fish species, and migratory fish species. Stabilizing conditions may also benefit the Brook Floater (*Alasmidonta varicosa*), a state endangered freshwater mussel that is a candidate for Federal listing, as presented in Table 5-21a.

Table 5-21a Target Species for the Burnt Mills Dam Removal Project

Species Name	Type	Federal/State Listed Status
Brook Floater (<i>Alasmidonta varicosa</i>)	Freshwater Mussel	Endangered – State
American Shad (<i>Alosa sapidissima</i>)	Fish	Not Listed
Blueback Herring (<i>Alosa aestivalis</i>)	Fish	In Review
American Eel (<i>Anguilla rostrata</i>)	Fish	Not Listed

5.21.5 Natural Resource and Human Use Benefits

Implementation of the Burnt Mills Dam Removal project would result in 0.15 miles of restored stream habitat that would create suitable habitat for the state endangered Brook Floater, improve water quality, stabilize rapidly eroding river banks, and improve sediment transport (Table 5-21c).

Table 5-21c Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Stream	0.15 miles	Creation of suitable habitat for the Brook Floater, improved water quality, stabilized bank erosion, improved sediment transport

Dam removal would address impacts from flooding, rapid erosion, and a potential future full dam failure. The community would benefit from this project, as the channel widening, floodplain lowering, and bank stabilization would reduce the amount of flooding experienced by nearby homeowners. Downstream water quality would improve through reduction of rapid erosion and deposition. Cutting the risk of a future dam failure would provide a safe and suitable habitat for at-risk freshwater mussel species downstream. This project would increase the likelihood that diadromous fishes would occupy the site and upstream sites further connecting the Lamington River to the Raritan River network.

5.21.6 Project Risks and Uncertainties

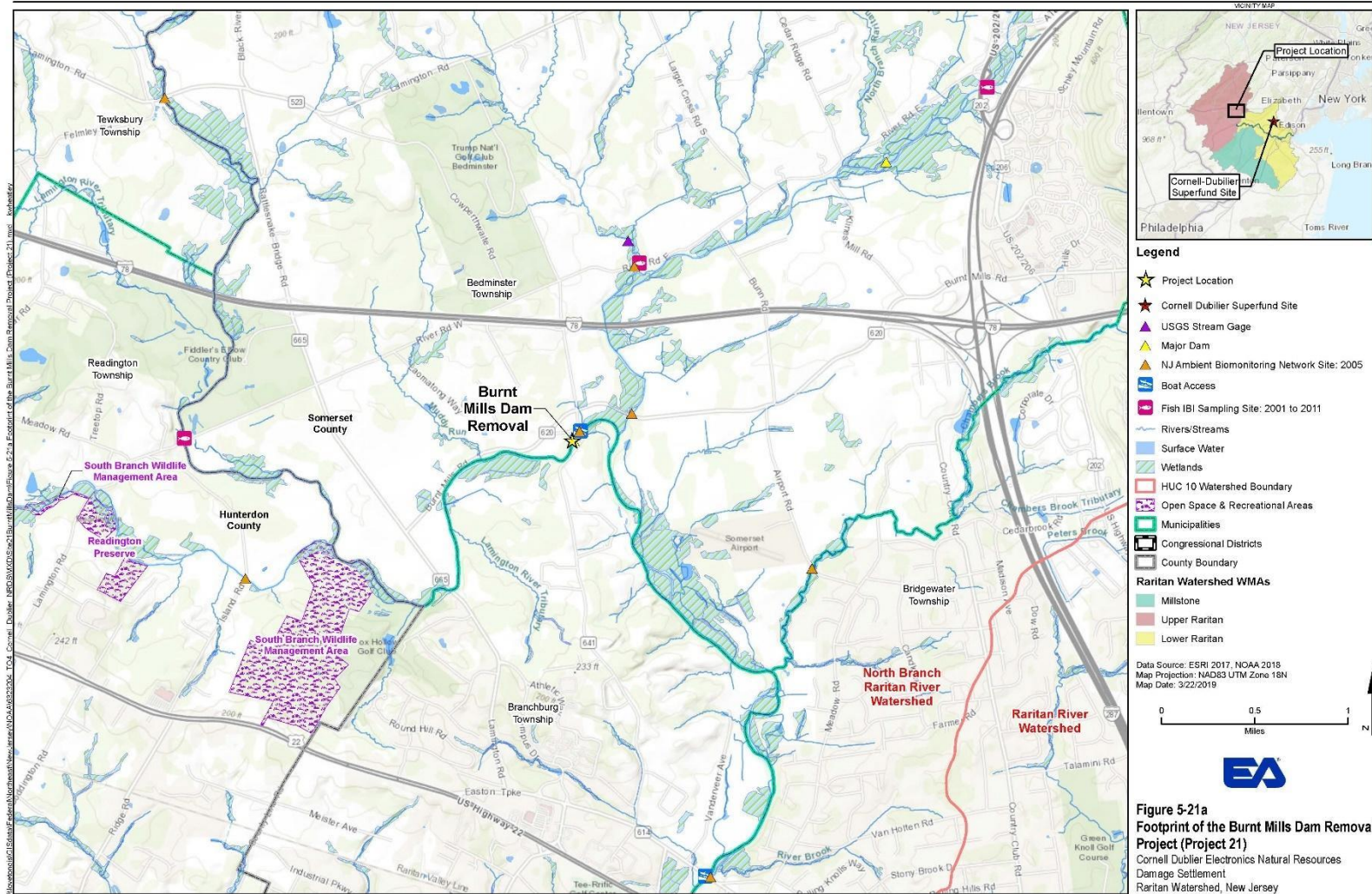
This project has potential risks/infeasibilities associated with regulatory processes. The Brook Floater, a state endangered and Federal ESA candidate species, as well as two additional state-

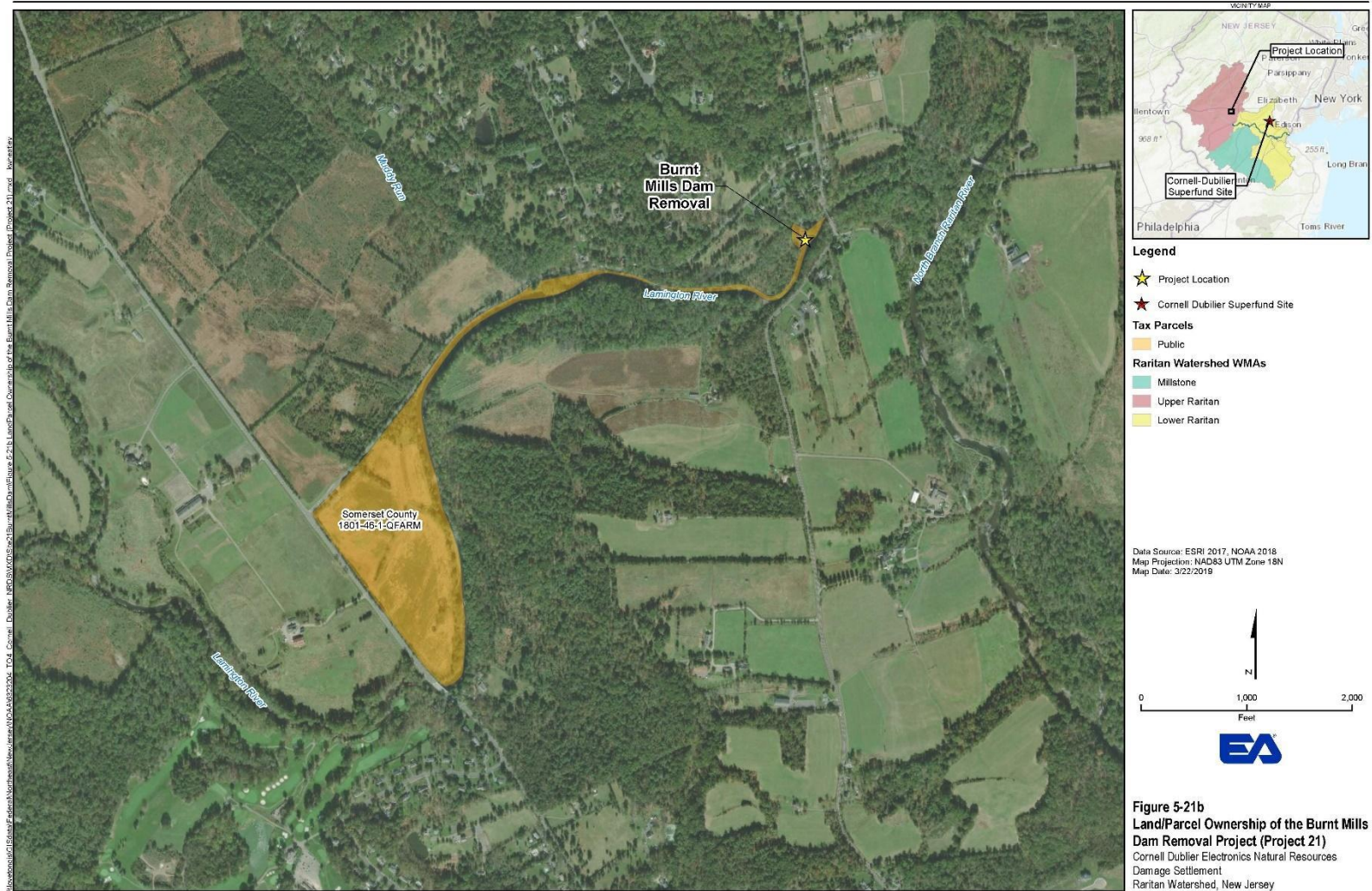
listed freshwater mussel species have been identified in the vicinity of the Burnt Mills Dam. A mussel avoidance and mitigation plan must be created as part of the permitting process, likely consisting of the relocation of mussels located within the site. The stakeholder provided an estimated cost of \$150,000 for this project, of which the stakeholder has \$70,000 in available funds.

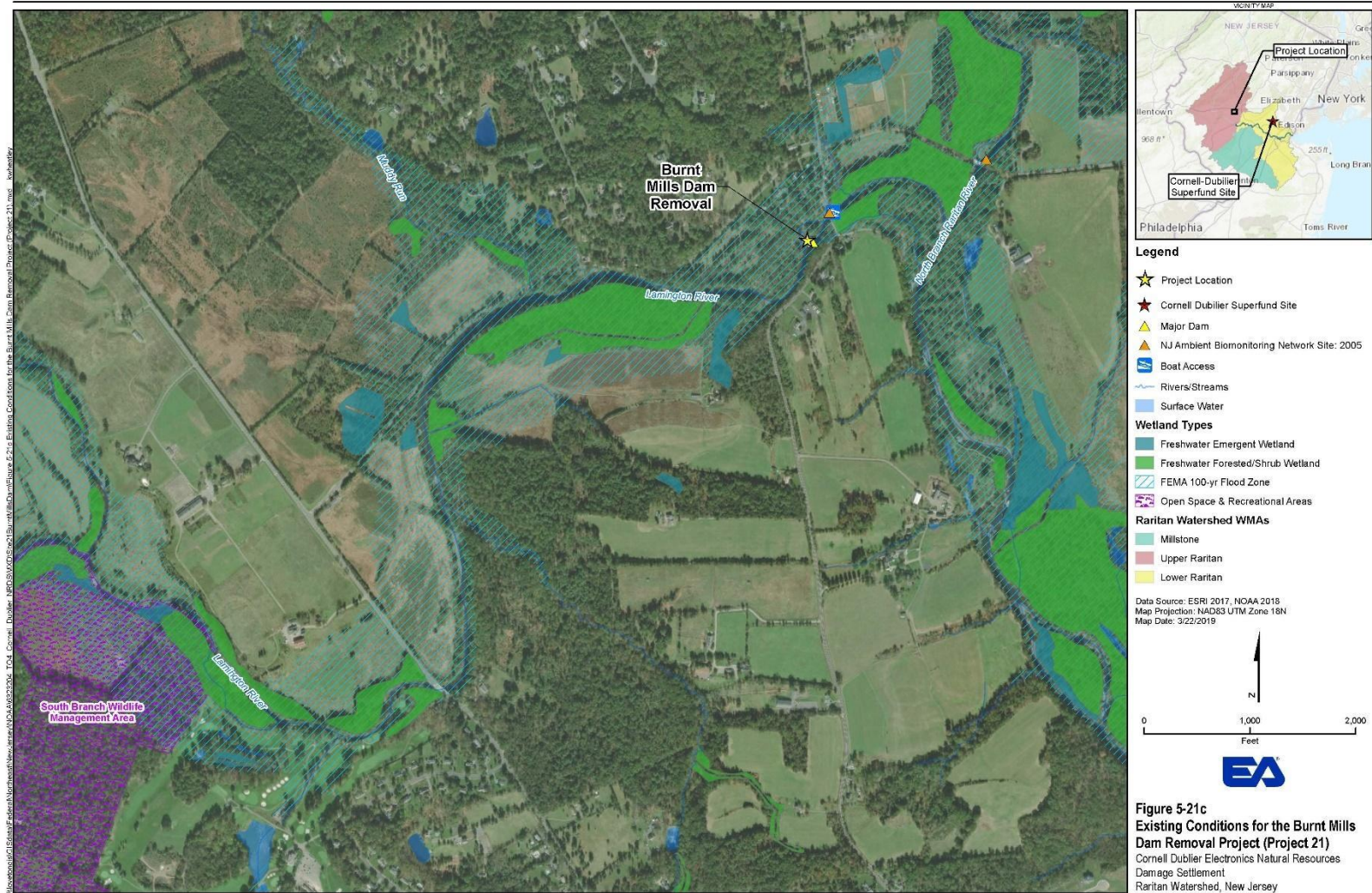
5.21.7 Resource Materials

Resources used in addition to those described in Section 5.1 include:

Burnt Mill Road Dam Removal and Channel Restoration-Channel Restoration Design document created by the U.S. Fish and Wildlife Service and Trout Scapes River Restoration, LLC for the Raritan Headwaters Association.







5.22 POND REMOVAL ON TRIBUTARY TO ROCKAWAY CREEK (PROJECT 22)

5.22.1 Project Stakeholder(s)

The Pond Removal on a Tributary to Rockaway Creek project was proposed by the USDA-NRCS and may be implemented in partnership with a private landowner. The project is currently in the final design stage and the project proponent is ready to apply for the appropriate permits.

5.22.2 Project Location and Background

The Pond Removal on a Tributary to Rockaway Creek (Project 22) is a proposed removal of an in-line manmade farm pond and restoration of that section of the stream. The project site is located on an 8-acre farm in Readington Township, Hunterdon County, New Jersey. The stream is an unnamed tributary flowing north to south to Rockaway Creek, which flows to the Lamington River and eventually enters the Raritan River. It is in the Upper Raritan River Watershed, one of the three major basins in the Raritan River Watershed (Figure 5-22a).

Although the project is small, it is important ecologically since the pond negatively impacts water quality in the tributary. In addition, it is important to note that projects with landowners with a direct impact to headwaters of a watershed are not common for USDA-NRCS.

5.22.3 Proposed Restoration Action

The project plan is to **remove** an existing in-line pond and **restore** a section of stream in the headwaters of the Rockaway River Watershed. Specific project components would include:

- Removal of an existing in-line man-made farm pond;
- Restoration of a section of stream channel;
- Creation of shallow water wetlands within the restored floodplains; and
- Planting of native trees, shrubs, and herbaceous vegetation.

5.22.4 Site Conditions

The land within the project site is located on a private 8-acre farm (Figure 5-22b). The stream in this area is surrounded by a buffer of freshwater forested/shrub wetland. A golf course surrounded by wooded area is located on the western and northern side of the site, while farmland is located directly south and east. The rest of the surrounding land is mostly agricultural or forested (Figure 5-22c).

Implementation of this project would benefit numerous wildlife species; the specific target species identified by the project proponent is the Brook Trout (*Salvelinus fontinalis*) as presented in Table 5-22a. In addition, an online review using the USFWS IPaC project review tool identified two species of bat and one turtle species listed as state or federally threatened or

endangered as being potentially present within the project site (Table 5-22b). No USFWS critical habitats are present within the project area.

Table 5-22a Target Species for the Pond Removal on a Tributary to Rockaway Creek Project

Species Name	Type	Federal/State Listed Status
Brook Trout (<i>Salvelinus fontinalis</i>)	Fish	Species of Concern – State

Table 5-22b Listed Status Species Potentially Present at the Pond Removal on a Tributary to Rockaway Creek Project Site

Species Name	Type	Federal/State Listed Status
Indiana Bat (<i>Myotis sodalis</i>)	Mammal	Endangered – Federal
Northern Long-eared Bat (<i>Myotis septentrionalis</i>)	Mammal	Threatened – Federal
Bog Turtle (<i>Clemmys muhlenbergii</i>)	Reptile	Threatened – Federal

5.22.5 Natural Resource and Human Use Benefits

Implementation of the Pond Removal on a Tributary to Rockaway Creek would result in 0.07 mile of stream enhancement, 1 acre of restored wetland habitat, 1 acre of enhanced floodplain, and 1 acre of enhanced riparian buffer (Table 5-22c).

Table 5-22c Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Wetland	1 acre	Restored floodplain hydrology, improved stream connectivity, improved water quality
Floodplain	1 acre	Stable banks, vegetation to provide shade to lower water temperature and create more habitat, flood attenuation
Riparian Buffer	1 acre	Stable banks, vegetation to provide shade to lower water temperature
Stream	0.07 mile	Improved stream connectivity, improved water quality

This project will naturalize the stream reach and improve water quality in a tributary that enters Rockaway Creek. New wetland habitats, and enhanced riparian buffers and floodplains, will help to stabilize banks, provide shade to lower stream water temperature, and create diverse habitat in the area. In addition, the improved water quality will benefit threatened species downstream of the site. Creating wetland topography will improve connectivity between the stream and floodplains and lessen the effects of potential flooding. Using native plants during the restoration and the creation of mounds and ridges within wetland areas may provide better nesting and predator-avoidance opportunities for reptiles. The USDA-NRCS rarely has the opportunity to work with private land owners in the headwaters of watersheds and, thus, this project is valuable for the organization.

5.22.6 Project Risks and Uncertainties

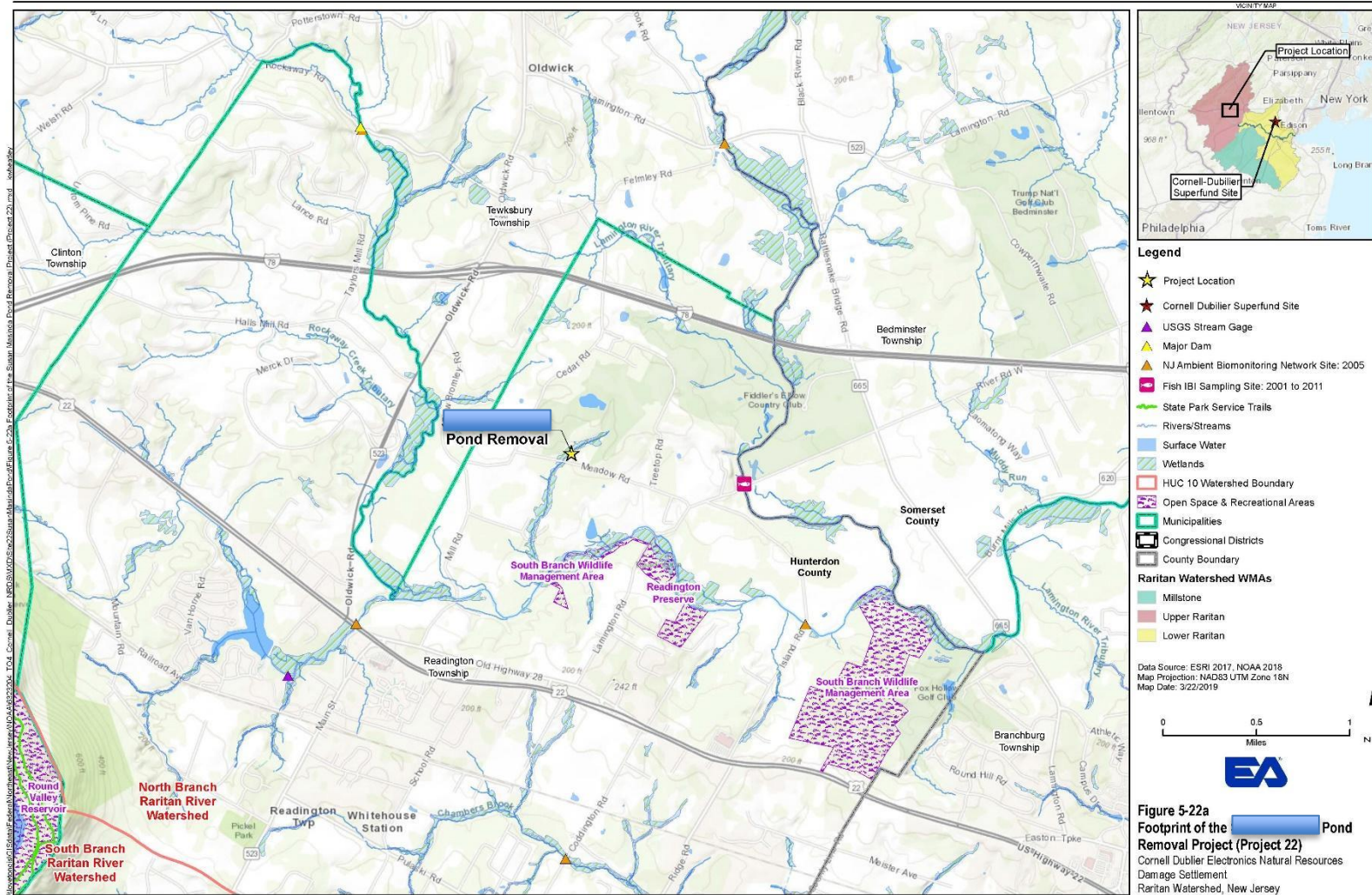
There are no major risks or uncertainties identified by the stakeholder for this project. The stakeholder provided an estimated cost of \$20,000, of which they have \$6,400 in available funds.

However, the financial responsibility of the stakeholder and partners requires resolution. Implementing a conservation easement or similar easement should be considered to protect the land from redevelopment.

5.22.7 Resource Materials

Resources used in addition to those described in Section 5.1 include:

Information was gathered from the USDA-approved Conservation Plan (2018), Draft Removal Design, and Draft Wetland Design.







5.23 MILL STREET DAM REMOVAL (PROJECT 23)

5.23.1 Project Stakeholder(s)

The Mill Street Dam Removal Project was proposed by USFWS. To date, no action for this project has been completed.

5.23.2 Project Location and Background

The Mill Street Dam is located on the North Branch Raritan River in Branchburg (west) and Bridgewater (east), Somerset County, New Jersey, approximately 45 miles west of New York City (Figure 5-23a). The project site is situated west of the CDE Superfund Site within the Upper Raritan Watershed (Figure 5-23a). A New Jersey Ambient Biomonitoring Network site is located immediately downstream of the dam. In addition, a USGS stream gauge is located at the Mill Street Dam (Figure 5-23a). This USGS gauge records discharge and gauge height.

The Mill Street Dam is a run-of-the-river dam approximately 200 ft. long. The dam is a low head weir dam and is partially collapsed on the weir wall side. The Mill Street Dam is the first impediment on the North Branch Raritan River and blocks passage of anadromous species such as Alewife (*Alosa pseudoharengus*), Blueback Herring (*Alosa aestivalis*), and American Shad (*Alosa sapidissima*). Three dams located downstream on the Raritan River have been previously removed. Two dams remain, Headgates (impassable) and Island Farm weir (partially passable fish ladder).

5.23.3 Proposed Restoration Action

The proposed action is a **dam removal** project that would **enhance** stream habitat. The proposed action would focus on the conservation of migratory fish species. The USGS stream gauge may have to be removed and relocated or recalibrated and repositioned within its current location. A feasibility study would be needed to evaluate options for dealing with the stream gauge.

5.23.4 Site Conditions

The land within the project site is located on a public parcel. The property owner to the west, in Branchburg, is NJDEP, and the property owner to the east, in Bridgewater, is the Somerset County Park Commission (Figure 5-23b).

There are no wetlands located in the immediate vicinity of the Mill Street Dam. Freshwater forested/shrub wetlands are located within the riparian area both upstream and downstream of the dam. Some freshwater emergent wetlands are located downstream of the dam within the Raritan River Confluence State Park (Figure 5-23c). The entirety of the project footprint is sited within the 100-year floodplain. The target species to benefit from this project are presented in Table 5-23a.

Table 5-23a Target Species for the Mill Street Dam Removal Project Site

Species Name	Type	Federal/State Listed Status
Alewife (<i>Alosa pseudoharengus</i>)	Fish	Not listed
Blueback Herring (<i>Alosa aestivalis</i>)	Fish	Not listed
American Shad (<i>Alosa sapidissima</i>)	Fish	Not listed
Sea Lamprey (<i>Petromyzon marinus</i>)	Fish	Not Listed
American Eel (<i>Anguilla rostrata</i>)	Fish	Not listed
Striped Bass (<i>Morone saxatilis</i>)	Fish	Not Listed

5.23.5 Natural Resource and Human Use Benefits

A total of 22.5 stream miles on the Lamington, North Branch and Rockaway Creek would become accessible to fish from the implementation of the proposed action. There would be improvements to water quality within the Lamington/Back River, particularly nutrient/sediment flux, and water temperatures. The removal of the Mill Street Dam would benefit migratory fish species moving upstream to spawn. Removal of the dam would open 22.5 miles of upstream fish habitat for migratory and resident fish species.

Table 5-23c Potential Post-Restoration Habitat Benefits

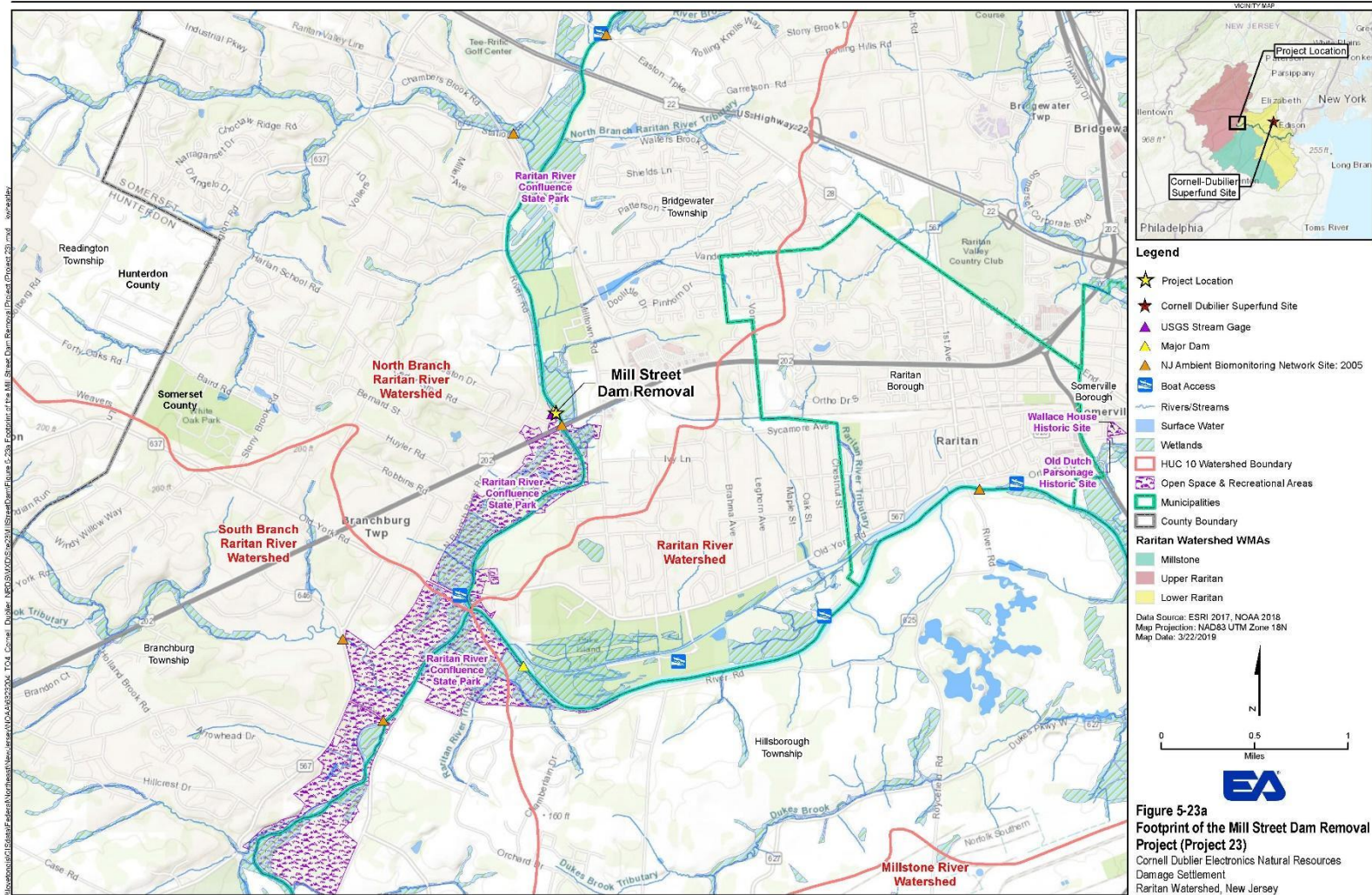
Habitat Type	Acreage/Mileage	Benefit Gained
Riverine	22.5 miles	Improved water quality; additional upstream habitat for anadromous fish species

5.23.6 Project Risks and Uncertainties

This project has potential risks/uncertainties related to site access, engineering design, and continuation of stream gage operations. The potential impacts of dam removal on the USGS stream gage that is located on the dam is unknown. There would likely need to be an alternatives analysis that specifically looks at options to deal with the USGS gage. It is unknown if NJ Water Supply Authority uses gauge data to inform their daily operations. The stakeholder did not provide an estimated cost for this project.

5.23.7 Resource Materials

No additional resource materials were available for this project.







5.24 BLACKWELLS MILLS DAM REMOVAL (PROJECT 24)

5.24.1 Project Stakeholder(s)

The Blackwells Mills Dam Removal project was proposed by The Watershed Institute (a/k/a Stony Brook-Millstone Watershed Association). Project partners have included and may include USFWS; American Rivers, the NOAA Community-Based Restoration Program, Conservation Resources, Inc., NJDEP, The Grendaline R. Dodge Foundation, and Patricia Kalleser of the D&R Canal State Park, representing the dam owner.

5.24.2 Project Location and Background

The Blackwells Mills Dam Removal Project (Project 24) is a proposed dam removal and alternative to the USGS stage/discharge gauge currently at the dam location. The dam is on the Millstone River located in Franklin Township on the border of Hillsborough Township in New Jersey. The dam is just north of Blackwells Mills Road in the D&R Canal State Park. The Millstone River generally flows south to north, eventually meeting the Raritan River, which then drains to Raritan Bay. The site is within the Millstone River Watershed, one of the three major basins in the Raritan River Watershed. At the location there is a USGS stream gauge (referred to above) and a New Jersey Ambient Biomonitoring Network site (Figure 5-24a).

The dam is currently the most downstream blockage of the Millstone River, since the Weston Mill Dam removal in 2017. Multiple formal reports by USGS, USFWS, and Princeton Hydro, LLC, have assessed the dam to be a barrier to anadromous fish passage. The dam's owner is interested in a removal of the structure to avoid potential liability for injury or property damage if the dam should fail. The dam is not in immediate danger to fail, but NJDEP has preliminarily classified it as a Significant Hazard Structure (Class II) and there exist a number of structural deficiencies that require maintenance.

The original Blackwells Mills Dam was no longer serving its original purpose as a millworks dam when it was reconfigured into a stream gaging weir in the 1930s by the USGS. It currently serves as a stable flow control for the USGS Blackwells Mills stream gage (01402000), but the weir's structural and functional integrity is questionable and could be replaced by new advanced technology gaging equipment that would not obstruct fish passage. The analysis for USGS stream gauge replacement and fish passage are still underway, but it has been determined that only full dam removal presents complete fish passage. Survey work and engineering designs have already been created by Princeton Hydro, LLC, and the State Historic Preservation Office and freshwater/wetlands permits have been acquired. The Watershed Institute, USFWS, NJDEP, Water Supply Authority, and USGS are determining the best option for a new stage/discharge stream gauge for the site since the data are used by the Water Supply Authority. After this is determined, the project can be advanced through final design, permitting, and construction.

5.24.3 Proposed Restoration Action

The proposed action is a **dam removal** project to **enhance** connectivity of the Millstone River, increasing fish passage to further upstream reaches and creating a more natural stream system. Specific project components may include:

- Install new gaging equipment needed to replace the existing weir;
- 1 to 2-year calibration period of the new gaging equipment to the existing;
- Removal of the concrete dam and spillway;
- Stabilization and naturalization of the river channel; and
- Potential native plantings on newly exposed sediment.

5.24.4 Site Conditions

The land within the project site is owned by the State of New Jersey through the D&R Canal State Park. According to the tax records, the dam is located within Lot 7A of Block 206 in Hillsborough Township and within Lot 2 of Block 60 in Franklin Township, both of which are owned by NJDEP (Figure 5-24b).

The dam spans across the entire river and is approximately 130 ft. long and 5 ft. high. A spillway is approximately 3 ft. high. The impoundment behind the dam extends 3.7 miles upstream, although the dam is only exposed during low flows. The dam is surrounded on all sides by freshwater forested/shrub wetlands and the entirety of the project footprint is sited within the 100-year floodplain. A street lies directly south and directly west of the structure and the area consists of a mix of agricultural and residential land. Emergent wetlands exist about 1,000 ft. north and east, and the site is located on the edge of what is considered an open space and recreational area (Figure 5-24c).

Implementation of this project would benefit numerous wildlife species; specific target species identified by the project proponent are presented in Table 5-24a and include several anadromous fish.

Table 5-24a Target Species for the Blackwells Mills Dam Removal Project

Species Name	Type	Federal/State Listed Status
Blueback Herring (<i>Alosa aestivalis</i>)	Fish	Species of Concern – State
Alewife (<i>Alosa pseudoharengus</i>)	Fish	Species of Concern – State
American Shad (<i>Alosa sapidissima</i>)	Fish	Species of Concern – State
American Eel (<i>Anguilla rostrata</i>)	Fish	Not Listed
Sea Lamprey (<i>Petromyzon marinus</i>)	Fish	Not Listed

5.24.5 Natural Resource and Human Use Benefits

Implementation of the Blackwells Mills Dam Removal project would result in the creation of a more natural stream system and increased fish passage for 18.6 river miles (Table 5-24c). Fish passage implementation at Blackwells Mills results in 9.4 miles of passage on the Millstone to the base of the Kingston Mill Dam just outside of Princeton Borough; 2.3 miles on the Six Mile

Run to where it deepens when joining with the Nine Mile Run; 4.4 miles on the Beden Brook to the first dam; 1.3 miles on the Rock Brook and 1.2 miles on the Pike Run for a total of 18.6 total stream miles gained.

Table 5-24c Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Stream	18.6 miles	Increased fish passage, creation of a more natural stream system

This project will remove the public safety hazard risk that the dam presents, increase fish passage, stem severe bank erosion undermining the foundation of the remnant mill structure at the failing left wing wall and help to create a more natural stream system. Failure of the dam has the potential to cause personal injury or property damage. Multiple agencies have determined that the Blackwells Mills Dam is a significant barrier to fish passage with an emphasis on native herring species, especially since it is the most downstream blockage of the Millstone River. By naturalizing the system, it is anticipated that benefits will be felt by the surrounding wetland habitats and aquatic species. For example, water temperature in the former dam impoundment should decrease, and wetland communities should adjust to the change in water depth and thrive in the more natural environment.

5.24.6 Project Risks and Uncertainties

This project has potential risks/infeasibilities associated with site control and access, engineering design, political/cultural concerns, permitting, and cost to complete. USGS opposes the removal of the dam because a USGS stream gauge at this location will be affected. Entities currently utilizing the gauge including USGS are determining the best option for dealing with the stage/discharge stream gauge for the site. Blackwells Mills Dam is within the Blackwells Mills-Millstone Historic District and is potentially eligible for listing. The project stakeholder provided an estimated cost of \$200,000 for completion of this project, of which they have \$75,000 in available funds.

5.24.7 Resource Materials

Resources used in addition to those described in Section 5.1 include:

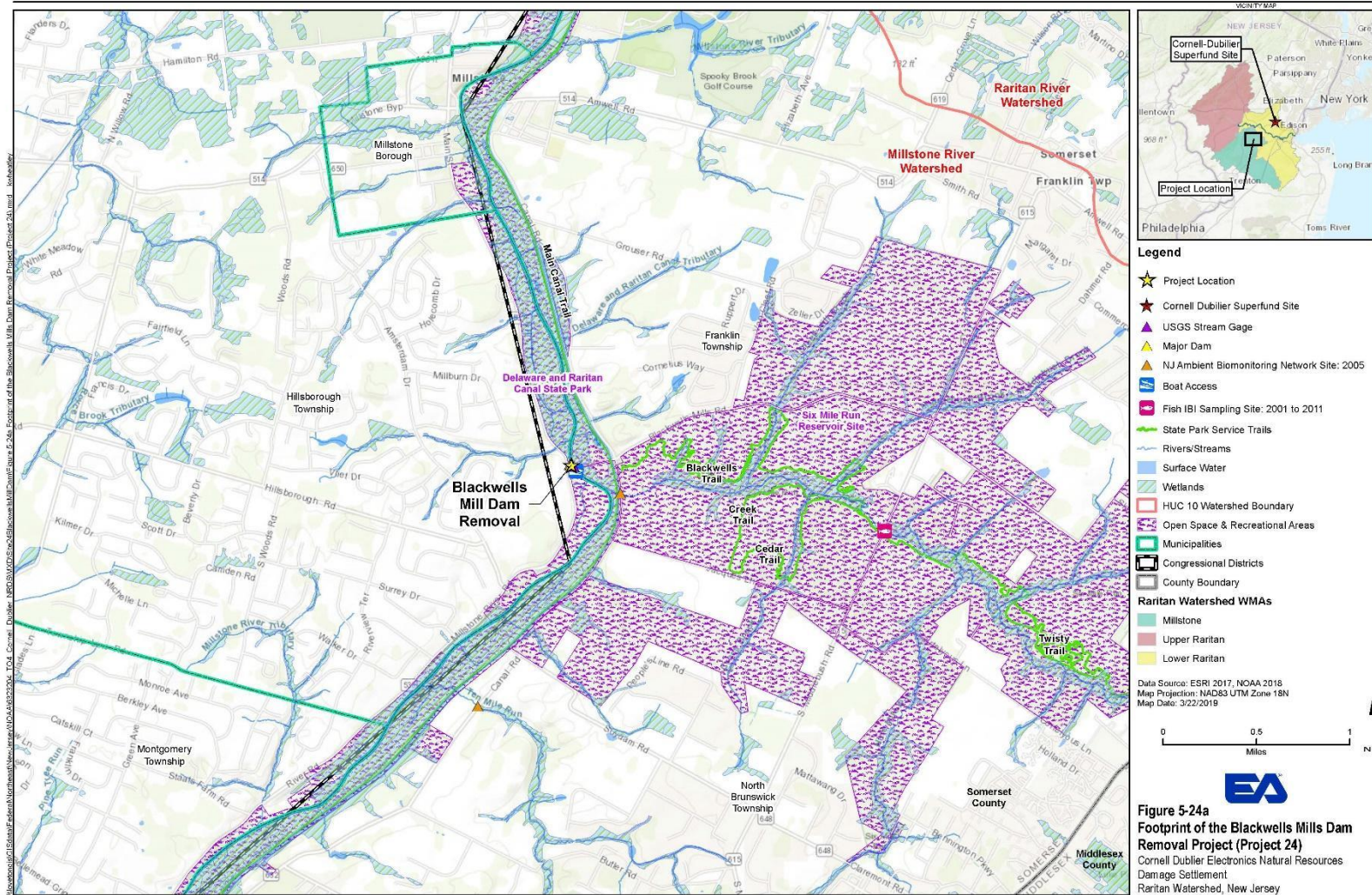
U.S Geological Survey and U.S. Department of Interior. Hydraulic and Biological Analysis of Passability of Select Fish Species at the U.S. Geological Survey Stream Gaging Weir at Blackwells Mills, New Jersey: Scientific Investigations Report 2017-5103.

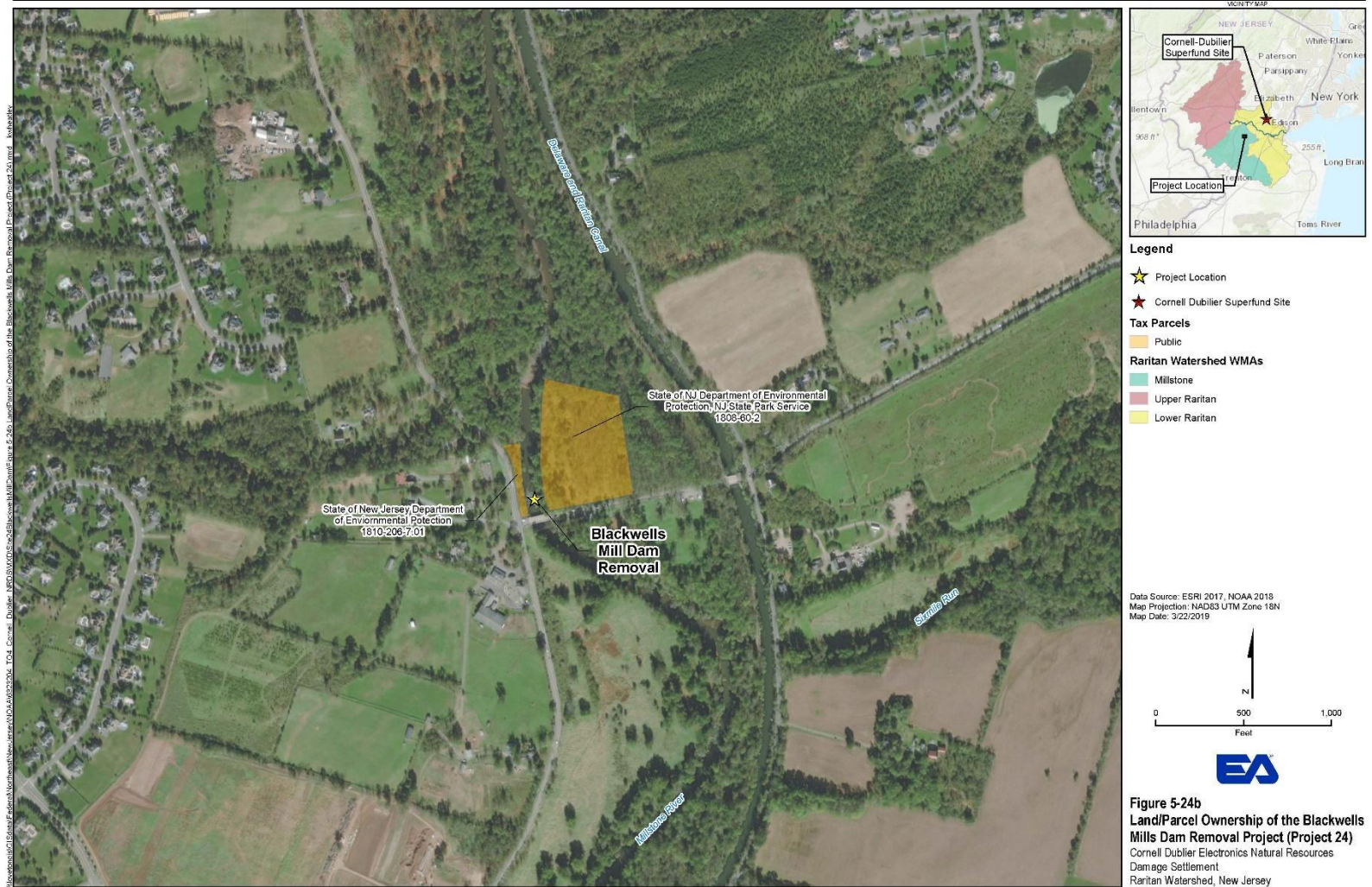
Stoney Brook-Millstone Watershed Association. 2011. *Feasibility Study for the Blackwells Mills Dam Removal*.

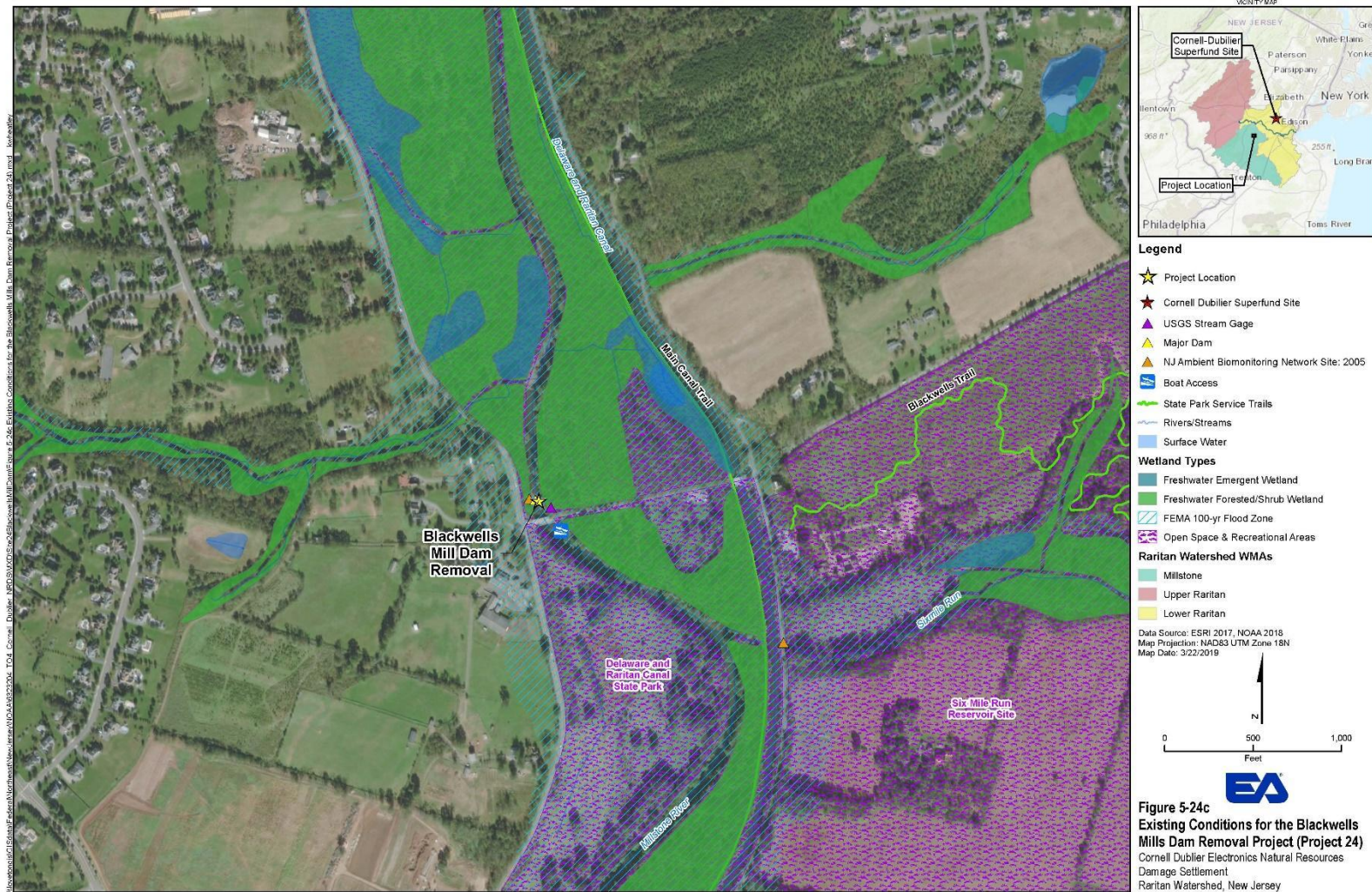
Hunter Research 2011. Phase 1A Cultural Resources Assessment Blackwells Mills Dam Removal Study Franklin and Hillsborough Townships Somerset NJ. September.

Stoney Brook-Millstone Watershed Association. August 2018. Alternatives Analysis, Blackwells

Mills Dam on the Millstone River







5.25 BROOK FLOATER RESTORATION (PROJECT 25)

5.25.1 Project Stakeholder(s)

The Brook Floater (*Alasmidonta varicosa*) Restoration Project was proposed by USFWS. Potential partners include the NJDEP Endangered and Nongame Species Program, Brook Floater Working Group, and local universities. To date, no action for this project has been completed.

5.25.2 Project Location and Background

The Brook Floater Restoration Project would occur primarily within the Lamington River, and potentially within Stony Brook and the North Branch Raritan River (Figure 5-25a). The Lamington River is a tributary of the North Branch Raritan River in central New Jersey. The Lamington River moves south through Somerset County and into the eastern edge of Hunterdon County. The Lamington River is a tributary to the North Branch Raritan located in the Upper Raritan Watershed and is situated west of CDE (Figure 5-25a). Stony Brook is a tributary of the Millstone River which ultimately feeds into the mainstem Raritan River. Stony Brook flows southeast through Hunterdon and Mercer counties in New Jersey where it drains into the Millstone River, just east of Princeton, New Jersey. Stony Brook is located in the Millstone River Watershed and is located south of CDE (Figure 5-25a). The North Branch Raritan River, a tributary of the Raritan River flows south from Morris County into Somerset County. It is located in the North Branch Raritan River Watershed, north of the CDE (Figure 5-25a).

The Brook Floater is a small freshwater mussel that ranges from the Savannah River Basin in South Carolina, to the St. Lawrence River Basin in Canada, and west to the Ohio River Basin in West Virginia. In New Jersey, low numbers of Brook Floater have been historically reported in Stony Brook, Lamington River, North Branch Raritan River, Musconetcong River, and the upper Delaware River. The Brook Floater requires clean flowing water over stable cobble, sand, and gravel substrates of small streams and rivers, little to no siltation, high dissolved oxygen, appropriate spawning temperatures, and adequate food availability. Reported host fishes include, but are not limited to, the Slimy Sculpin (*Cottus cognatus*), Longnose Dace (*Rhinichthys cataractae*), Blacknose Dace (*Rhinichthys atratulus*), Golden Shiner (*Notemigonus crysoleucas*), Pumpkinseed (*Lepomis gibbosus*), Yellow Perch (*Perca flavescens*), and Margined Madtom (*Noturus insignis*).

The Brook Floater was listed as state endangered in 2002. Low population numbers of Brook Floater reported in occupied habitats indicate that little new reproduction is occurring. However, Brook floater populations are under-surveyed in New Jersey. In 2010, USFWS received a petition to list the Brook Floater as threatened or endangered under the ESA. As of 2018, USFWS is conducting a Species Status Assessment that will ultimately inform future ESA decisions.

5.25.3 Proposed Restoration Action

The proposed action is a **conservation** project that would **restore** Brook Floater in the Lamington River, and possibly in Stony Brook and North Branch Raritan River. This project would include initial investigation to quantify the current population status and distribution of the Brook Floater in the Lamington (and possibly additional areas). Quantitative sampling efforts would follow techniques established in the Brook Floater Rapid Assessment Monitoring Protocol (Sterrett et al. 2018). After the distribution and population dynamics of the Brook Floater is determined, secondary actions for this project may include the protection of and/or restoration of Brook Floater habitat. Protection and restoration measures could include reducing flooding/scouring, riparian planting, dam removal, and instream habitat work. An additional secondary restoration action includes the potential for propagation and population augmentation. Several USFWS National Fish Hatchery (NFH) facilities are capable of propagating Brook Floater (e.g., Richard Cronin NFH - Massachusetts; Harrison Lake NFH - Virginia; North Attleboro NFH - Massachusetts).

5.25.4 Site Conditions

The land within the project site is comprised of multiple counties with multiple parcel owners. Because the project area is so large, this information cannot be concisely summarized here for the purposes of this report.

Many of the areas along Lamington River, Stony Brook, and the North Branch Raritan River occur within the 100-year floodplain. The Lamington River, Stony Brook, and the North Branch Raritan River support habitat for the state endangered Brook Floater. Due to the large size of the potential project area, an IPaC review was not performed.

Table 5-25a Target Species for the Brook Floater Restoration Project

Species Name	Type	Federal/State Listed Status
Brook Floater (<i>Alasmidonta varicosa</i>)	Mussel	State Endangered

5.25.5 Natural Resource and Human Use Benefits

Implementation of this project would document where Brook Floater occurs within the Lamington River, Stony Brook (tributary of the Millstone), and the North Branch Raritan River. Following documentation, river reaches with suitable habitat would be protected and enhanced creating beneficial impacts to brook floaters and other imperiled mussel species (Table 5-25b).

Table 5-25b Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Riverine	To Be Determined	Brook floater habitat protection and enhancement. Restored brook floater population

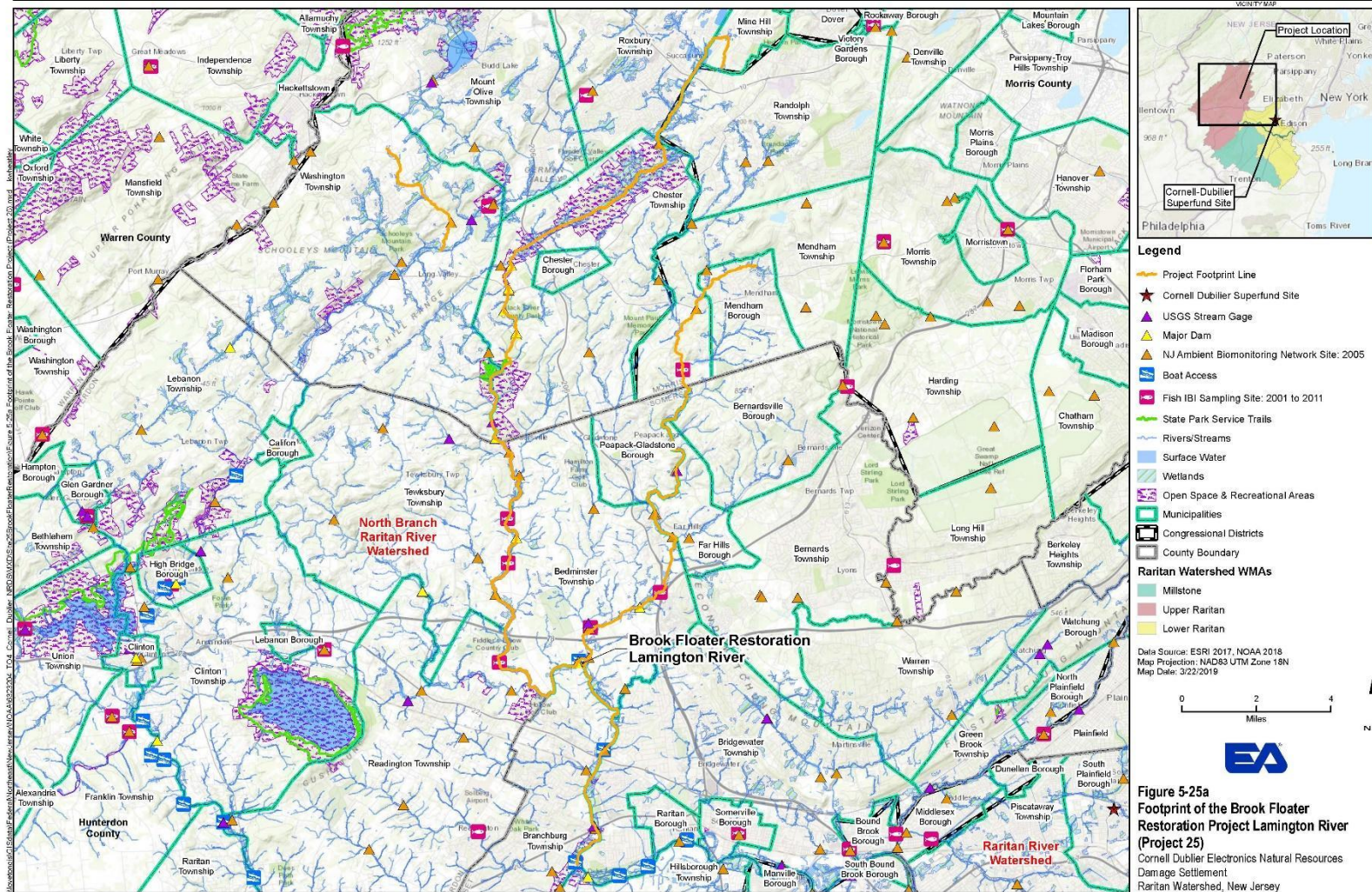
5.25.6 Project Risks and Uncertainties

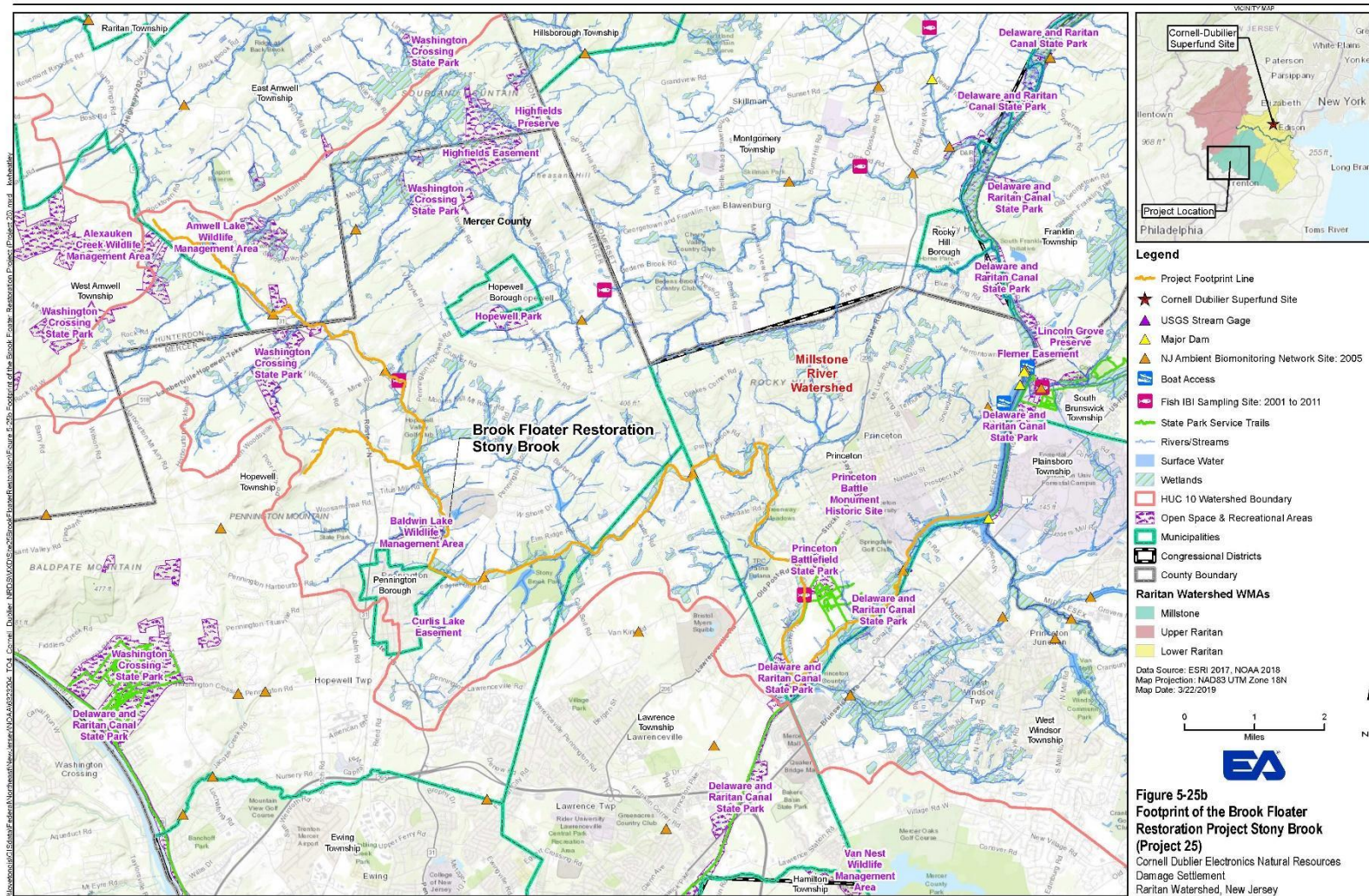
The species restoration components of this project would require regulatory review and collaboration by the USFWS and NJDEP. Biosafety protocols may need to be established in the case of population augmentation through stocking of propagated individuals. Similar USFWS-led projects have been implemented in Virginia, North Carolina, Massachusetts, and may afford additional information regarding potential risks and uncertainties. Project costs are unknown.

5.25.7 Resource Materials

Resources used in addition to those described in Section 5.1 include:

Sterrett, S., A. Roy, P. Hazelton, B. Watson, B. Swartz, T.R. Russ, L. Holst, M. Marchand, J. Wisniewski, M. Ashton, and B. Wicklow. 2018. *Rapid Assessment Monitoring Protocol*. Cooperator Science Series #132-2018.





5.26 FURNACE ROAD DAM REMOVAL (PROJECT 26)

5.26.1 Project Stakeholder(s)

The Furnace Road Dam Removal project was proposed by USFWS. To date, no action for this project has been completed.

5.26.2 Project Location and Background

Furnace Road Dam is located on the Lamington/Black River, in Chester Township, Morris County, New Jersey, approximately 35 miles northwest of New York City (Figure 5-26a). The project site is situated northwest of the CDE within the Upper Raritan Watershed (Figure 5-26a). New Jersey Ambient Biomonitoring Network sites are located approximately 0.25 mile west of the site on Tanners Brook and 1 mile south of the site on the Lamington/Black River. Furnace Road Dam is the 8th identified barrier heading upstream on the Lamington/Black River. There are four major dams/natural barriers occur within 1.8 miles south and downstream of Furnace Road (Figure 5-26a).

Furnace Road Dam is a relatively small, run-of-the-river dam that is adjacent to Patriots Path and the Black River Wildlife Management Area, approximately 7 to 8 miles from the Lamington/Black River headwaters. It is the furthest upstream barrier on the Lamington/Black River. It is unlikely that anadromous species such as Alewife (*Alosa pseudoharengus*), Blueback Herring (*Alosa aestivalis*) and American Shad (*Alosa sapidissima*) can access the Lamington/Black River upstream of Pottersville, New Jersey, due to increased stream slope and current velocities, and decreased stream depth. However, this section of the Lamington/Black River is considered cold-water habitat and suitable for cold-water fish such as trout and other non-game species.

5.26.3 Proposed Restoration Action

The proposed action is a **dam removal** project that would **enhance** stream habitat. It includes the ground-truthing of the exact location of Furnace Road Dam and potential dam removal. The proposed action would focus on the conservation and maintenance of cool/cold-water fish species. There are two wild trout streams located within Hacklebarney State Park: Trout Brook and Rinehart Brook. The Lamington/Black River is regularly stocked with Brown Trout (*Salmo trutta*), Rainbow Trout (*Oncorhynchus mykiss*), and Brook Trout (*Salvelinus fontinalis*). NJDEP Division of Fish and Wildlife would be consulted to determine if dam removal would be beneficial to cool-water species and habitats of the Upper Lamington/Black River.

5.26.4 Site Conditions

The land within the project site is located on a public parcel owned by NJDEP (Figure 5-26b). A private parcel is located just east of the dam.

Furnace Road Dam creates an impoundment that is partially or wholly sediment filled and there is little open water available. However, the area is characterized by hydric soils and wetland

vegetation. There are no wetlands at the dam location (Figure 5-26c). The freshwater emergent wetlands are mostly located adjacent upstream of the dam, while the forested and scrub-shrub wetlands are located adjacent downstream of the dam. The entirety of the project footprint is sited within the 100-year floodplain.

Habitat surrounding Furnace Road Dam is suitable for several New Jersey state-listed species, including but not limited to, the state endangered Brook Floater (*Alasmidonta varicosa*), the state threatened Triangle Floater (*Alasmidonta undulata*), and the state species of concern Creeper (*Strophitus undulatus*). All three species, as well as other state-listed and common mussel species are known to occur within the Lamington River and Raritan River. The emergent wetlands surrounding the Furnace Road Dam have the potential to support the federally threatened and state endangered bog turtle. Target species for restoration as identified by the project proponent are presented in Table 5-26a. Additionally, an online review using USFWS IPaC tool was performed for the project site; two mussels were identified as potentially present (Table 5-26b).

Table 5-26a Target Species for the Furnace Road Dam Removal Project

Species Name	Type	Federal/State Listed Status
Brook Floater (<i>Alasmidonta varicosa</i>)	Mussel	State Endangered
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Fish	Not listed
Brown trout (<i>Salmo trutta</i>)	Fish	Not listed
Brook Trout (<i>Salvelinus fontinalis</i>)	Fish	Not listed
Triangle Floater (<i>Alasmidonta undulata</i>)	Mussel	State Threatened
Creeper (<i>Strophitus undulatus</i>)	Mussel	Not Listed

Table 5-26b Listed Status Species Potentially Present at the Furnace Road Dam Removal Project Site

Species Name	Type	Federal/State Listed Status
Brook Floater (<i>Alasmidonta varicosa</i>)	Mussel	State Endangered

5.26.5 Natural Resource and Human Use Benefits

A total of 13.3 miles of stream would be enhanced from the implementation of the proposed action (Table 5-26c).

Table 5-26c Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Riverine	13.3 miles	Improved water quality; additional habitat for anadromous fish species; enhanced brook floater habitat

This project would involve improvements to water quality within the Lamington/Back River, particularly nutrient/sediment flux, and water temperatures. The removal of Furnace Creek Dam would benefit many cold-water fish species including Brown Trout, Rainbow Trout, and Brook Trout. The enhanced stream would also benefit the state-listed mussel species including the Brook Floater, which is known to occur within the Lamington River.

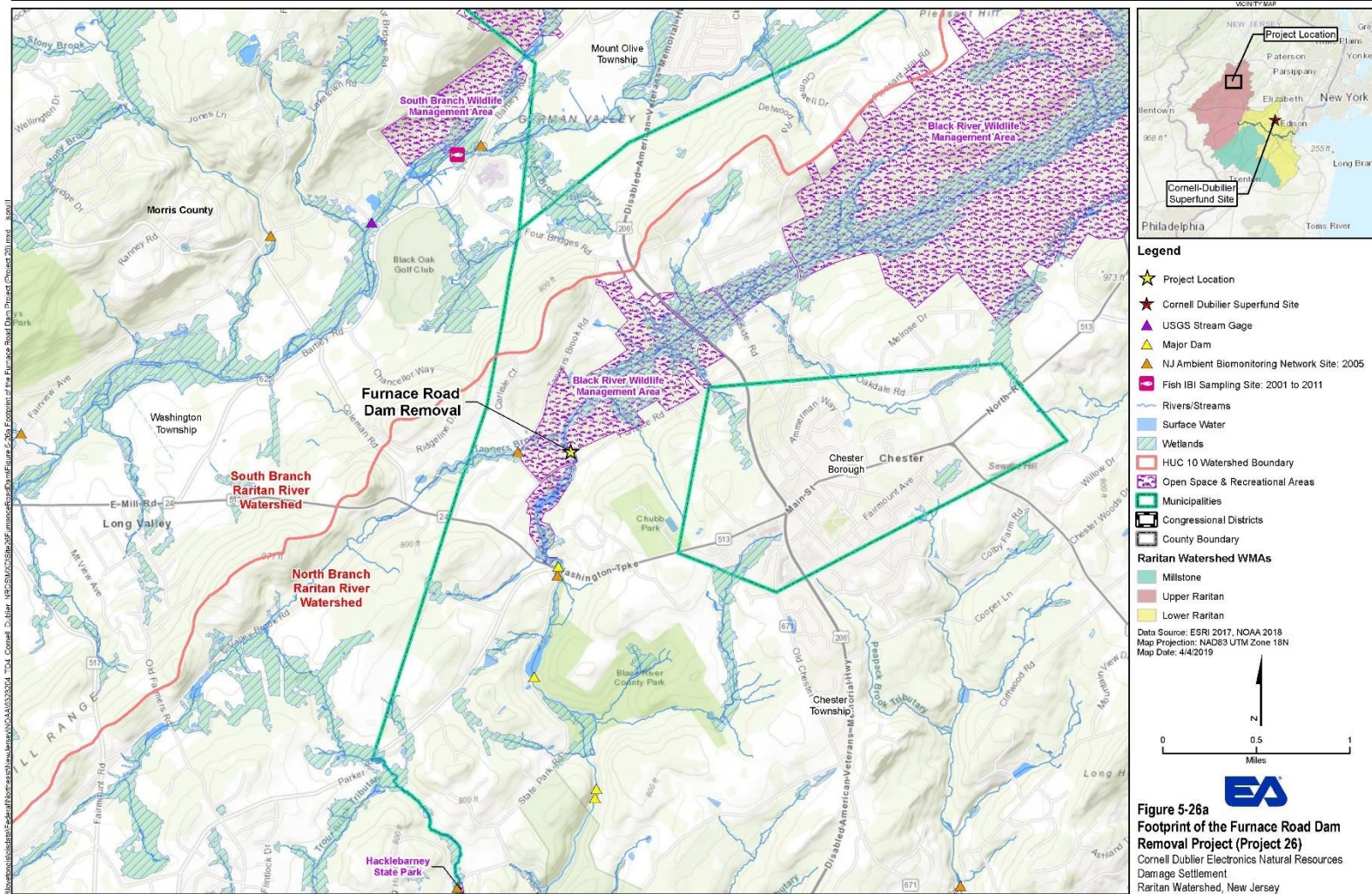
The Cooper Grist Mill and Dam is located 0.9 miles downstream of Furnace Road Dam. The stone mill built in 1826 sits on the site of an original mill built in 1788 is still operational and is a historical tourism attraction. The removal of Furnace Creek Dam has the potential to impact the operation of the mill.

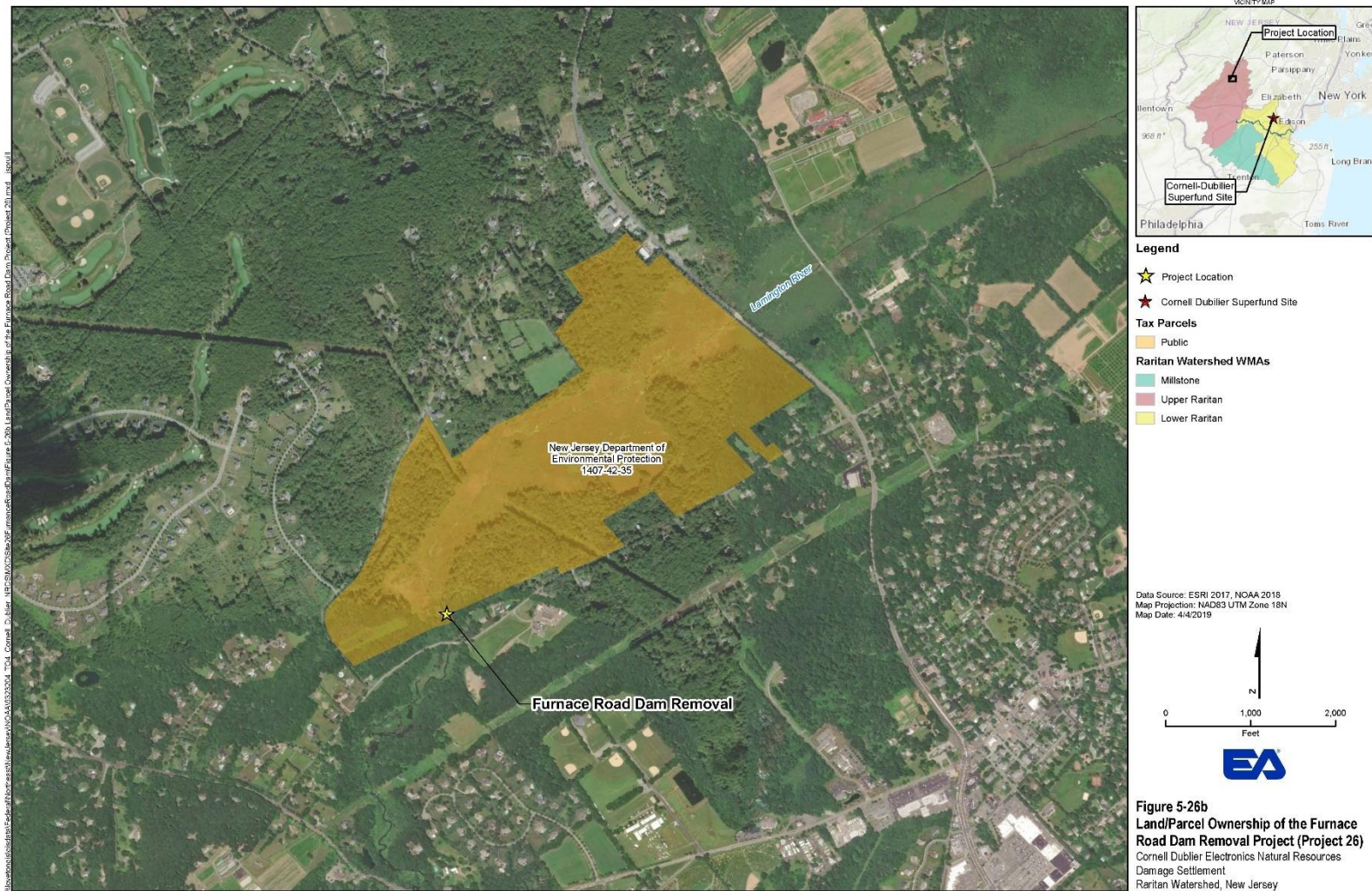
5.26.6 Project Risks and Uncertainties

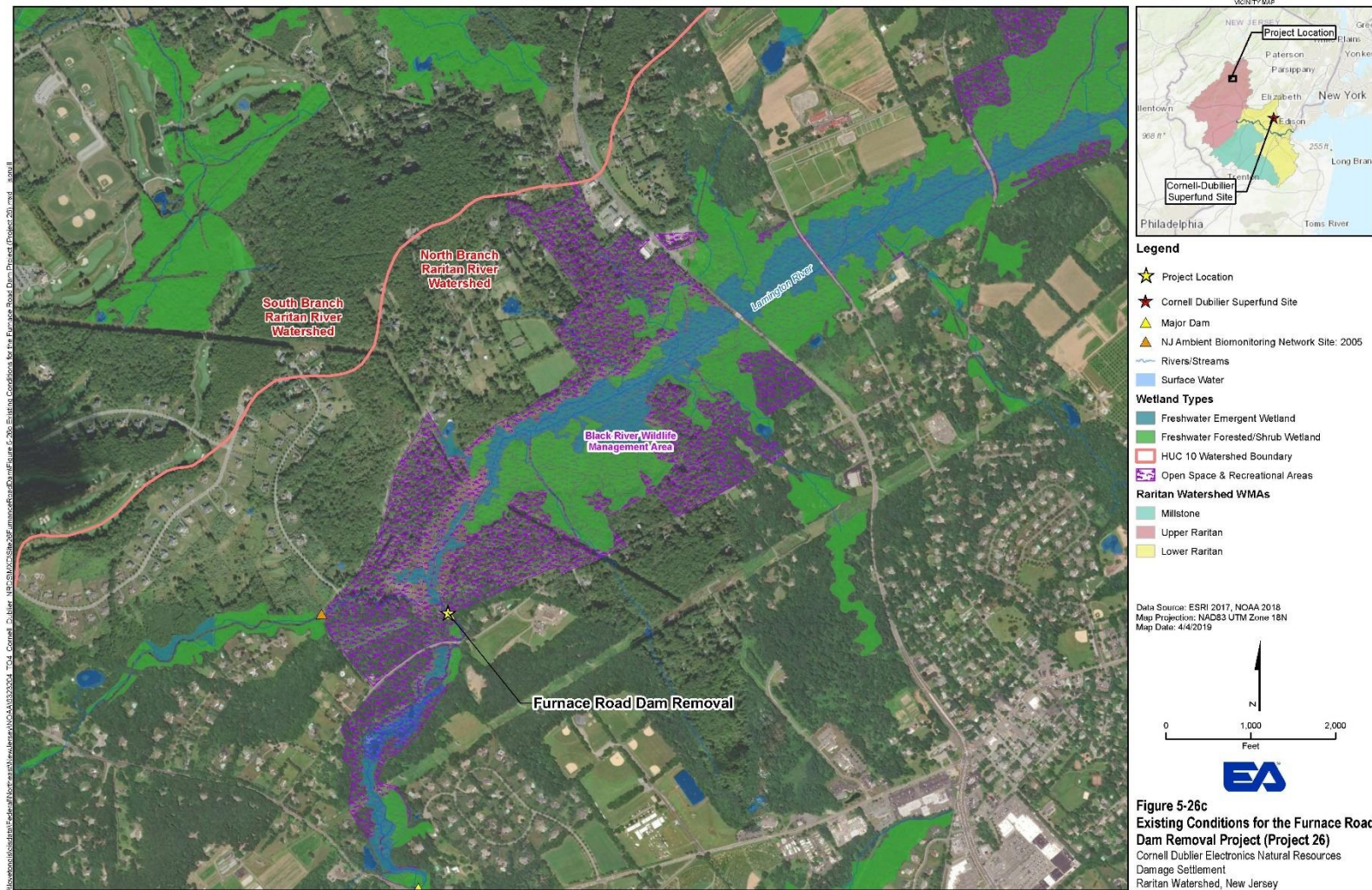
This project has potential risks/infeasibilities associated with permitting. Dam ownership is undetermined. The dam is situated between a private land holding and NJDEP lands. Project costs are unknown, but not anticipated to exceed \$1 million.

5.26.7 Resource Materials

No additional resource materials were available for this project.







5.27 LAMINGTON/BLACK RIVER DAM #4 (PROJECT 27)

5.27.1 Project Stakeholder(s)

The Lamington/Black River Dam #4 project was proposed by USFWS. To date, no action for this project has been completed.

5.27.2 Project Location and Background

Lamington/Black River Dam #4 is located on the Lamington/Black River, in Chester Township, Morris County, New Jersey, approximately 35 miles northwest of New York City (Figure 5-27a). The project site is situated northwest of CDE within the Upper Raritan Watershed (Figure 5-27a). A New Jersey Ambient Biomonitoring location is situated approximately 2 miles upstream of the site. There are two major dams located on the Lamington/Black River upstream of Dam #4 (Figure 5-27a). The next upstream dam on the Lamington/Black River is Kays Pond Dam. Lamington/Black River Dam #2 is located approximately 7 miles downstream of Dam #4.

Lamington/Black River Dam #4 is a relatively small, run-of-the-river rock/concrete dam, located within Black River County Park (Figure 5-27a). It is unlikely that anadromous species such as Alewife (*Alosa pseudoharengus*), Blueback Herring (*Alosa aestivalis*) and American Shad (*Alosa sapidissima*) can access the Lamington/Black River upstream of Pottersville, New Jersey, due to increased stream slope and current velocities, and decreased stream depth. However, this section of the Lamington/Black River is considered cold-water habitat and suitable for cold-water fish such as trout.

5.27.3 Proposed Restoration Action

The proposed action is a **dam removal** project that would **enhance** stream habitat and includes the ground truthing of the exact location of the Lamington/Black River Dam #4 and potential dam removal. The proposed action would focus on the conservation and maintenance of cool/cold-water fish species and habitats. There are two wild trout streams located within Hacklebarney State Park: Trout Brook and Rinehart Brook. The Lamington/Black River is regularly stocked with Brown Trout (*Salmo trutta*), Rainbow Trout (*Oncorhynchus mykiss*), and Brook Trout (*Salvelinus fontinalis*). NJDEP Division of Fish and Wildlife would be consulted to determine if dam removal would be beneficial to cool-water species and habitats of the upper Lamington/Black River.

5.27.4 Site Conditions

The land within the project site is located on a public parcel owned by Morris County Park Commission (Figure 5-27b).

Lamington/Black River Dam #4 is located adjacent to the historic ruins of an old mill. The dam is less than 4 ft. high and is approximately 25 to 30 ft. wide. The dam impounds a small pool that is impacted by sediment. No forested or emergent wetlands are located within the

immediate vicinity of the dam. The entirety of the project footprint is sited within the 100-year floodplain.

Habitat surrounding Lamington/Black River Dam #4 may be suitable for the New Jersey state endangered Brook Floater (*Alasmodonta varicosa*). The Brook Floater prefers small streams and rivers with sand/ gravel/pebble bottoms. Brook Floater is known to occur within the Lamington River and Raritan River. Target species for restoration as identified by the project proponent are presented in Table 5-27a. Additionally, an online review using USFWS IPaC tool was performed for the site; the review identified two mussel species.

Table 5-27a Target Species for the Lamington/Black River Dam Project

Species Name	Type	Federal/State Listed Status
Brook Floater (<i>Alasmodonta varicosa</i>)	Mussel	State Endangered
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Fish	Not listed
Brown trout (<i>Salmo trutta</i>)	Fish	Not listed
Brook Trout (<i>Salvelinus fontinalis</i>)	Fish	Not listed
Triangle Floater (<i>Alasmodonta undulata</i>)	Mussel	State Threatened
Creeping (<i>Strophitus undulatus</i>)	Mussel	Not listed

Table 5-27b Listed Status Species Potentially Present at Lamington/Black River Dam Project Site

Species Name	Type	Federal/State Listed Status
Brook Floater (<i>Alasmodonta varicosa</i>)	Mussel	State Endangered

5.27.5 Natural Resource and Human Use Benefits

The removal of Dam #4 would enhance less than 1.0 miles of stream habitat (Table 5-27c), since the Lamington/Black River Dam #5 presents an obstruction to fish passage several hundred feet upstream. However, dam removal would improve water quality within the Lamington/Black River, particularly regarding water temperatures.

Table 5-27c Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Riverine	< 1.0 miles	Improved water quality; additional habitat for anadromous fish species; enhanced brook floater habitat

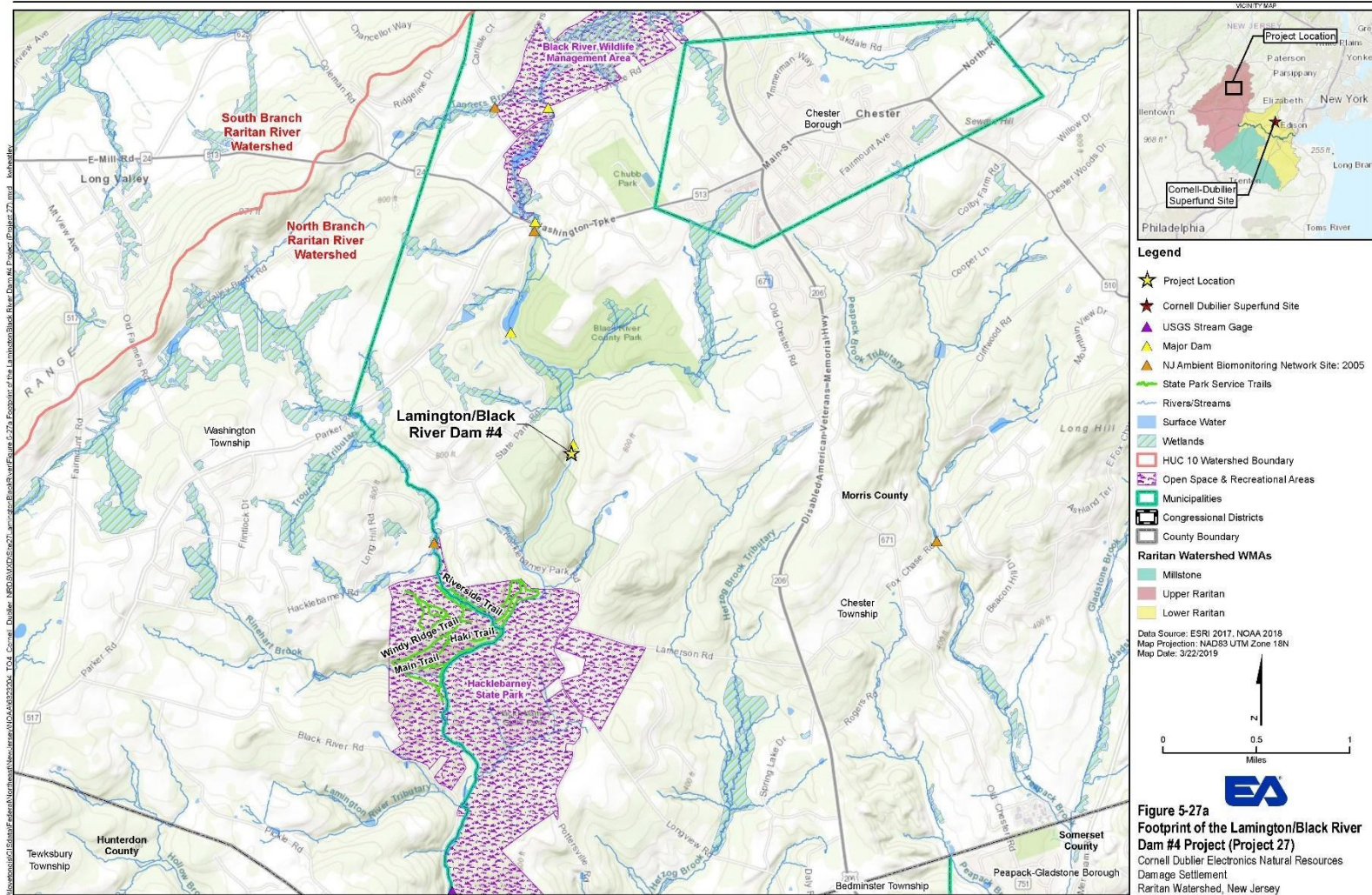
The removal of Lamington/Black River Dam #4 would benefit many cold-water fish species including Brown Trout, Rainbow Trout, and Brook Trout by providing less than 1.0 miles of unobstructed streams up to the base of Kay's Pond Dam less than a mile upstream. The enhanced stream would also benefit the state-listed mussel species including the Brook Floater, which is known to occur within the Lamington River.

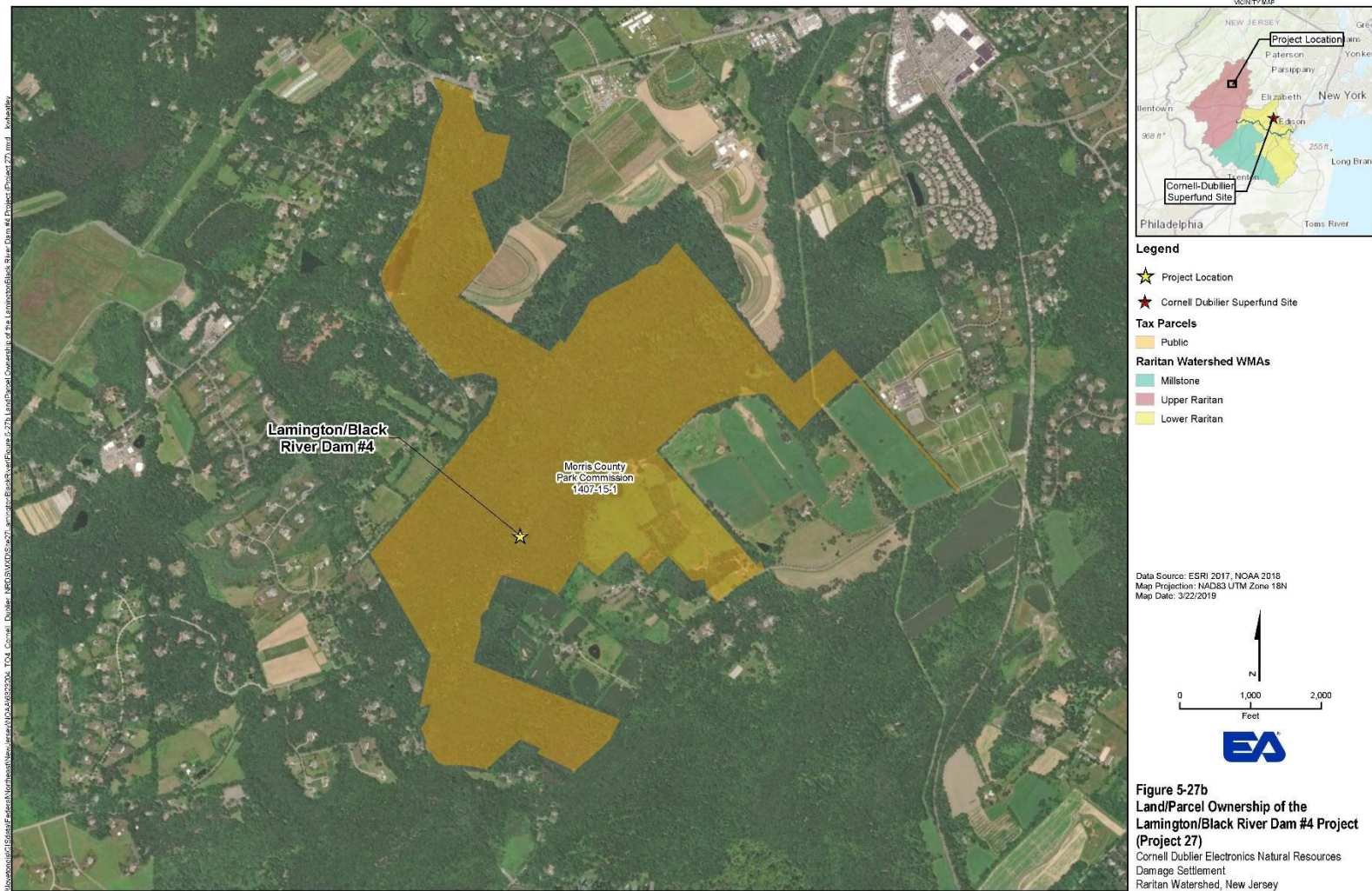
5.27.6 Project Risks and Uncertainties

The exact location of this dam is unknown. Heavy machinery access to the dam would be challenging due to the dam's remote location. Project costs are unknown.

5.27.7 Resource Materials

No additional resource materials were available for the project.







5.28 BOAT RAMP DOCK AT BOYD PARK (PROJECT 28)

5.28.1 Project Stakeholder(s)

The Boat Ramp Dock at Boyd Park project was proposed by the City of New Brunswick and the State of New Jersey.

5.28.2 Project Location and Background

The Boat Ramp Dock at Boyd Park (Project 28) is a proposed boat dock to accompany the boat ramp constructed at Boyd Park in 2011. Boyd Park is located in the city of New Brunswick along the Raritan River, about 12 river miles upstream of Raritan Bay. The site is located in the Lower Raritan River Watershed, one of the three main basins of the Raritan River Watershed (Figure 5-28a).

Before 2011, the City of New Brunswick and the State of New Jersey worked on a project to expand Route 18 and, in the process, improve surrounding land including Boyd Park. A boat ramp was installed in the park, and the original plan was to also build a dock to accompany the ramp. This dock would be used to tie-off boats to assist in loading and unloading boats from car trailers. The existing setup requires that boaters get in and out of the water and then access their vehicle without a place for the boat to be tied off. The addition of this dock should increase the amount of recreation opportunities on the Raritan River in the form of increased boater activity.

5.28.3 Proposed Restoration Action

The proposed action is a **recreation** project to **increase functionality** of the boat ramp and to allow recreational opportunities in the area. Specific project components would include:

- Creation of a boat dock to accompany the already existing boat ramp; and
- Increase in recreational opportunities related to boating.

5.28.4 Site Conditions

The project site is located at Boyd Park, which is owned by the City of New Brunswick (Figure 5-28b). The entirety of Boyd Park is sited within the 100-year floodplain. The dock would be located on the bank at a point where the Raritan River is about 500 ft. across. On the opposite side of Boyd Park is Route 18, and behind this continues the city of New Brunswick. The site is classified as estuarine and is tidally influenced.

5.28.5 Natural Resource and Human Use Benefits

Building a dock at Boyd Park Boat ramp would benefit the community by enhancing the opportunity for recreation. Boaters heading out alone, or with others that lack the ability or experience of launching and driving a boat, currently have no place to tie off their boat while moving their vehicle and trailer away from the ramp. Additionally, the person operating the

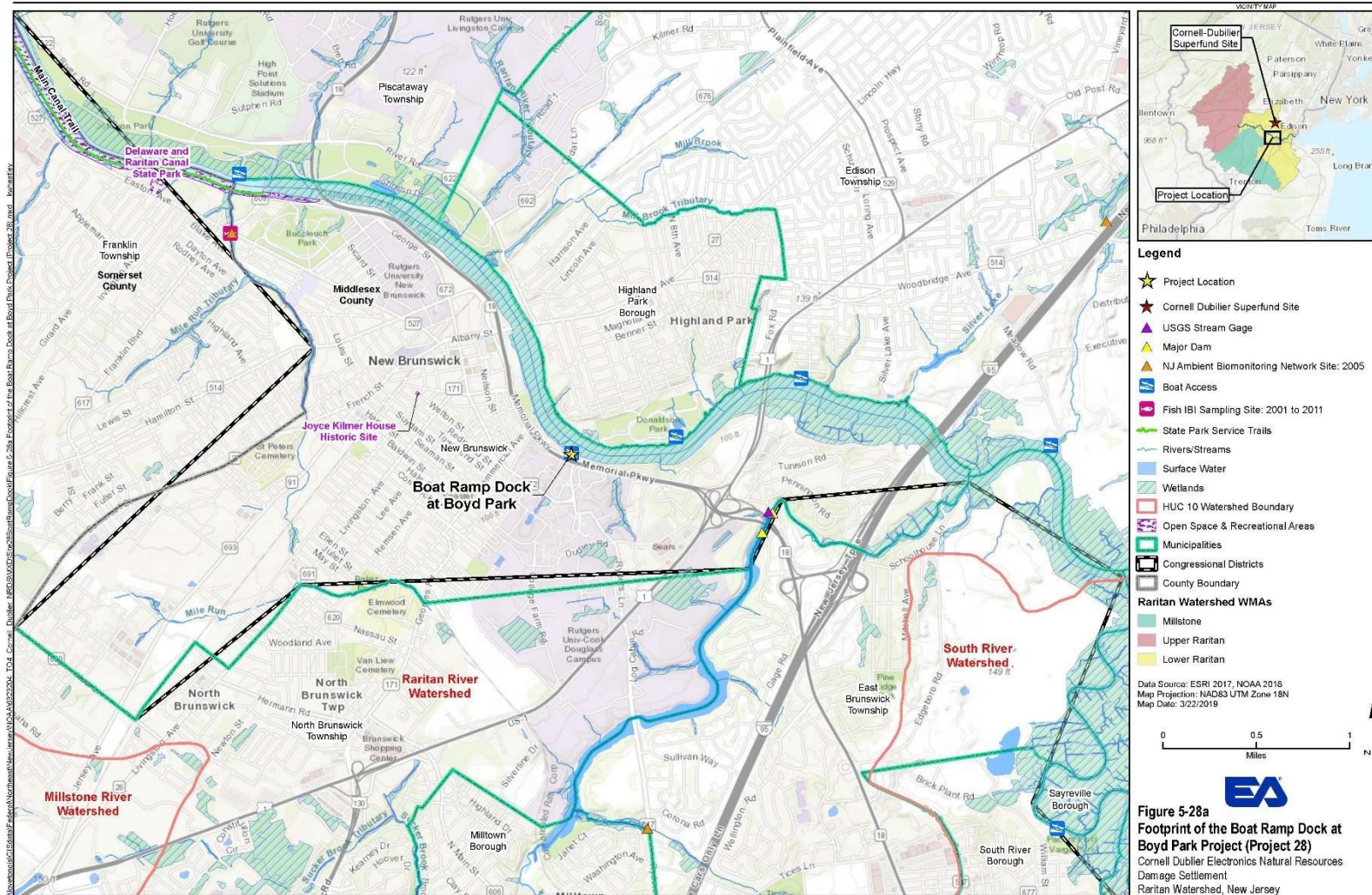
vehicle and trailer may be forced to enter the water to get on the boat after it is launched, creating safety issues. Boaters who otherwise would not have been able to use the ramp because of these reasons would be able to access the Raritan River from Boyd Park. The dock would make launching, loading, and unloading significantly easier. The amount of recreational boating from Boyd Park would increase.

5.28.6 Project Risks and Uncertainties

There would be potential regulatory hurdles related to working in water and NJDEP (and other regulatory agencies) would need to determine the potential impact to fish and wildlife. Additionally, information may need to be gathered to ensure that the anticipated public usage/need would support construction of a boat dock in this location. The project stakeholder provided an estimated project cost of \$20,000, of which they have \$5,000 in available funds.

5.28.7 Resource Materials

No additional resource materials were available for the project.







5.29 STONY BROOK GREEN INFRASTRUCTURE DEMONSTRATION PROJECT (PROJECT 29)

5.29.1 Project Stakeholder(s)

The Stony Brook Green Infrastructure Demonstration Project was proposed by the Watershed Institute. To date, the project design is complete and requests for quotes to complete the work is ongoing.

5.29.2 Project Location and Background

The Stony Brook Green Infrastructure Demonstration Project is located in Hopewell Township, Mercer County, New Jersey, approximately 60 miles southwest of New York City (Figure 5-29a). The project site is situated southwest of CDE within the Millstone Watershed (Figure 5-29a).

The Watershed Reserve is a heavily used environmental site that requires a considerable amount of parking due to visitors attending conferences, educational classes, and school field trips. In addition, hundreds of summer campers visit the facility every day throughout the summer months. The parking lots, entry drive, and exit roads are comprised of asphalt and gravel and do not infiltrate stormwater. Runoff and sediments, especially from the gravel parking lot, drain into the tributary and storm sewers that lead to Stony Brook. Invasive plants are found within the riparian areas along the entry drive and have adverse impacts on water quality or quantity. This area drains to Stony Brook and is located upstream from a Category One stream segment with several species of imperiled mussels.

5.29.3 Proposed Restoration Action

The proposed action is a **green infrastructure** project to **restore** and **enhance** riparian area. It would include making improvements to the parking lot, entry drive, and exit roads at the Watershed Reserve that would reduce stormwater entering the tributary and ultimately Stony Brook. Specific project components would include:

- Installing bioswales to capture, treat, and hold stormwater along the west side of the entry drive. Removing invasive species along the east side of the entry side and both sides of the tributary near the neighboring farmland.
- Planting native species within these riparian areas. Native species would include canopy, understory, and ground plants that would out-compete invasive species after completion of the project.
- Installing porous pavement demonstration practices in the entry drive, 14,000-square-ft parking area and exit drive. This would provide different pavement techniques that would act as a demonstration for property owners to visit and determine if the various porous pavements could be applied within their property. In addition, academic groups would research more permeable pavements and how they function.

5.29.4 Site Conditions

The land within the project site is located on a private parcel owned by Stony Brook Millstone Watershed (Figure 5-29b).

The Watershed Reserve includes approximately 1,000 acres of forest, wetlands, meadows, and farmland. More than 10 miles of hiking trails are available for visitors. The hiking trails wind through the different habitats and pass by two historic 18th and 19th century farmsteads. The riparian forests that border Stony Brook are dominated by American sycamore (*Platanus occidentalis*) and American beech (*Fagus grandifolia*) trees. Wildlife including red fox (*Vulpes vulpes*), Coyote (*Canis latrans*), weasel (*Mustela*), flying squirrel (*Pteromyini*), and White-Tailed Deer (*Odocoileus virginianus*) can be observed within the Reserve. Common birds include Osprey (*Pandion haliaetus*), Bobolink (*Dolichonyx oryzivorus*), Cooper's Hawk (*Accipiter cooperii*), Red-Shouldered Hawk (*Buteo lineatus*), and six species of owl (The Watershed Institute 2019). The Reserve's meadows support many pollinator species including a variety of butterflies and bees. Stony Brook provides potential habitat to many reptile and amphibian species. In addition, there is potential that some of New Jersey's imperiled mussel species can occur within Stony Brook, including Brook Floater (*Alasmidonta varicosa*), Creeper (*Strophitus undulatus*), Eastern Pondmussel (*Ligumia nasuta*), Green Floater (*Lasmigona subviridis*), and Triangle Floater (*Alasmidonta undulata*).

Implementation of the proposed action would be completed in areas of the parking lot, entrance and exit drives, and riparian areas within the immediate vicinity of the infrastructure. These areas are predominately paved. Invasive species within the riparian area do occur. There are no documented wetland areas in the immediate vicinity of where construction would occur; however, wetland delineation is needed to verify this. In addition, the project footprint would not occur within the 100-year floodplain. Target species for restoration include aquatic species that would benefit from the reduction of stormwater entering the tributary and Stony Brook. These species as identified by the project proponent are presented in Table 5-29a. Additionally, an online review was performed for the project site using USFWS IPaC tool; four listed mussels were identified as potentially present within the project footprint (Table 5-29b).

Table 5-29a Target Species for the Stony Brook Green Infrastructure Project

Species Name	Type	Federal/State Listed Status
Brook Floater (<i>Alasmidonta varicosa</i>)	Mussel	State Endangered
Creeper (<i>Strophitus undulates</i>)	Mussel	Not Listed
Eastern Pondmussel (<i>Ligumia nasuta</i>)	Mussel	State Threatened
Green Floater (<i>Lasmigona subviridis</i>)	Mussel	State Endangered
Triangle Floater (<i>Alasmidonta undulata</i>)	Mussel	State Threatened
Creeper (<i>Strophitus undulates</i>)	Mussel	Not Listed

Table 5-29b Listed Status Species Potentially Present at Stony Brook Green Infrastructure Project Site

Species Name	Type	Federal/State Listed Status
Brook Floater (<i>Alasmidonta varicosa</i>)	Mussel	State Endangered
Eastern Pondmussel (<i>Ligumia nasuta</i>)	Mussel	State Threatened

Green Floater (<i>Lasmigona subviridis</i>)	Mussel	State Endangered
Triangle Floater (<i>Alasmidonta undulata</i>)	Mussel	State Threatened

5.29.5 Natural Resource and Human Use Benefits

Overall, if implemented, the proposed action would improve stormwater management at the Reserve and restore the riparian buffer (Table 5-29c). Approximately 3,850 linear ft. of tributary leading to Stony Brook would be enhanced immediately through the implementation of the green infrastructure through the reduction of stormwater. This would have a beneficial impact on the water quality downstream of the Reserve and the habitat for imperiled mussel species. A total of 3 acres of wetlands would be improved through the riparian planting program. Nine acres of riparian habitat would be enhanced with the planting of native vegetation that would benefit the ecosystem and absorb stormwater. Approximately 12 acres of upland area would be improved through the implementation of various types of environmentally sensitive projects that would work with the Reserve's natural topography. Eleven acres of upland area would be protected by reducing stormwater runoff and erosion. Improvements resulting from the green infrastructure to the various habitats within the Reserve would also be beneficial for wildlife.

Table 5-29c Potential Post-Restoration Habitat Benefits

Habitat Type	Acreage/Mileage	Benefit Gained
Riverine	0.73 mile	Improved water quality
Wetland	3 acres	Non-native vegetation removal; native species planted
Upland	12 acres	Native species; habitat enhancement
Upland	11 acres	Reduction in stormwater runoff and erosion

The proposed action would play a significant role in educating visitors of the Reserve on stormwater management and the role stormwater plays in degrading waterways, specifically Stony Brook, if left uncaptured or untreated. Through signage, brochures, presentations, and educational programs, this project would be a valuable demonstration tool to explain stormwater management.

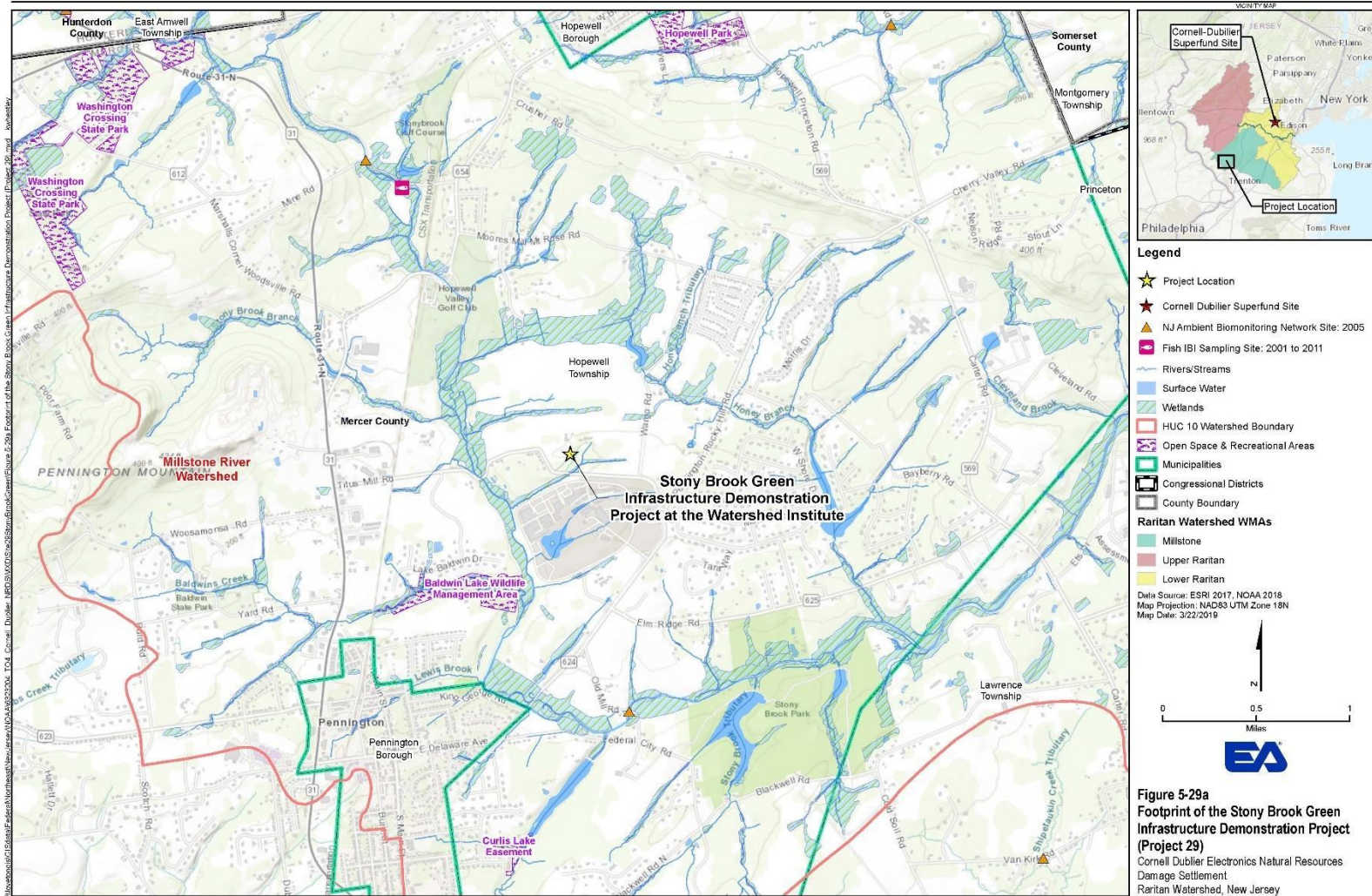
5.29.6 Project Risks and Uncertainties

The stakeholder did not identify any major risks and uncertainties. To correlate the anticipated improved water quality for mussel habitat with implementation of the controls described in Section 5.29.3, it is recommended that the sponsor enumerate the reduction of nitrogen and phosphorous loading into Stony Brook. The stakeholder did not provide an estimated project cost.

5.29.7 Resource Materials

Resources used in addition to those described in Section 5.1 include:

The Watershed Institute. 2019. <https://thewatershed.org/>. Accessed on 19 March 2019.







5.30 RARITAN CENTER DEGRADED WETLAND PROJECT (PROJECT 30)

5.30.1 Project Stakeholder(s)

The Raritan Center Degraded Wetland Project was proposed by NJDEP. This project is currently in the concept planning phase.

5.30.2 Project Location and Background

The Raritan Center Degraded Wetland Project is located in Edison Township, Middlesex County, New Jersey, approximately 30 miles southwest of New York City (Figure 5-30a). The project site is situated southeast of CDE within the Lower Raritan Watershed (Figure 5-30a). The Raritan Center degraded wetlands are located on the north bank of the tidal Raritan River approximately 2 miles upstream of the Edison Bridge Route 9/Garden State Parkway crossing.

The site already had one small wetland mitigation completed in 2009; however, it was overrun and partially destroyed during Hurricane Sandy. More specifically, during the storm, the freshwater wetland mitigation site was overtaken by tidal salt water. Most of the freshwater wetland plants have since died or were scoured out by the storm surge. A network of culverts and road beds dissect and regulate the flow of water in and out of the freshwater wetlands.

5.30.3 Proposed Restoration Action

The proposed action is a **wetland** project that would **restore** and **enhance** wetland habitat. Specific project components would include:

- Hydrologic modeling to determine if restoration efforts for the freshwater wetland is achievable.
- Creating breaches in the road bed dikes.
- Replacing culverts with larger openings followed with elevation changes.
- Removing common reed (*Phragmites australis*) within the wetland and planting *Spartina* grasses.

Modeling efforts would consider climate change and sea level rise to determine the sustainability of any restoration efforts. Similar wetland enhancement at nearby sites has been largely successful.

5.30.4 Site Conditions

The land within the project site is comprised of multiple private parcels owned by Federal Business Centers, Inc. (Figure 5-30b).

The Raritan Center project area includes a total of 455.58 acres of wetlands and 11.4 miles of linear stream (Figure 5-30c). The majority of the wetlands are estuarine and marine wetlands. Some areas of freshwater emergent wetlands and freshwater forested/shrub wetlands are located

on the northern portion of the site. Portions of the project area are within the 100-year floodplain. Target species for restoration as identified by the project proponent are presented in Table 5-30a. An online review using the USFWS IPaC tool was performed for the project site and no listed status species are likely to occur within the project area.

Table 5-30a Target Species for the Raritan Center Degraded Wetland Project

Species Name	Type	Federal/State Listed Status
American eel (<i>Anguilla rostrata</i>)	Fish	Not listed
Spartina (<i>Spartina</i>)	Grass	Not listed

5.30.5 Natural Resource and Human Use Benefits

Overall, if implemented, this project would enhance over 400 acres of wetlands (Table 5-30c). Non-native common reed would be removed throughout the wetland and native *Spartina* grasses would be planted. The use of native *Spartina* grass would also benefit the native wildlife that use these areas. The enhanced habitat and improved water quality of the Raritan River would also benefit important fish species including American Shad (*Alosa sapidissima*), River Herring (*Alosa pseudoharengus*), and American Eel (*Anguilla rostrata*). The public would also have access to the enhanced wetlands.

Table 5-30b Potential Post-Restoration Habitat Benefits

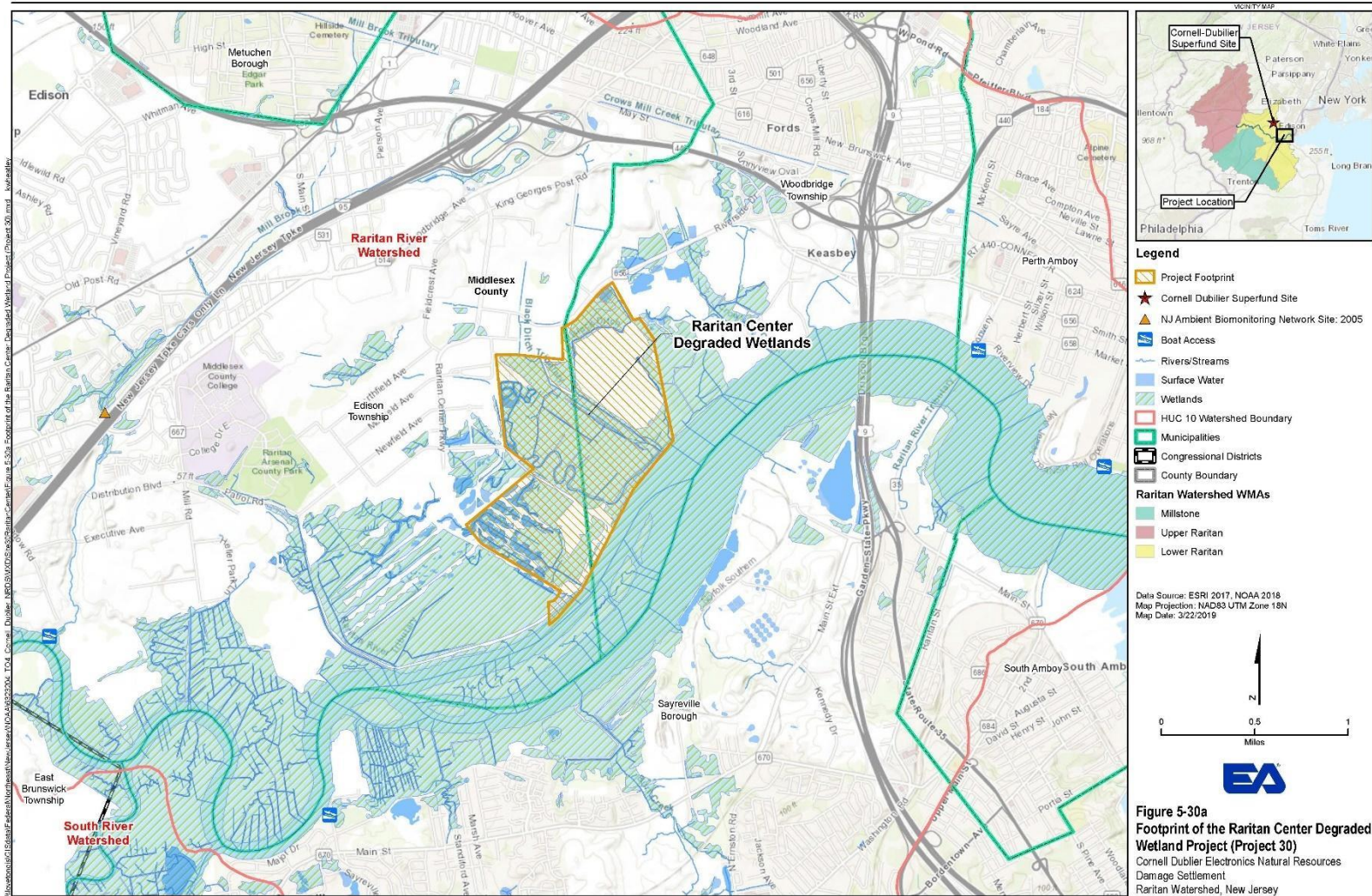
Habitat Type	Acreage/Mileage	Benefit Gained
Wetland	400 acres	Native grass; Habitat enhancement; Improved water quality

5.30.6 Project Risks and Uncertainties

This project has potential risks/infeasibilities regarding site control/access, engineering design, and cost to complete. Due to the industrialized nature of the project area, it is possible that the lands to be restored contain contaminants consistent with those present throughout the lower watershed. As such, the project may present a remedial challenge that may affect project costs. However, the project stakeholder did not provide an estimated project cost.

5.30.7 Resource Materials

No additional resource materials were available for the project.







APPENDIX A: STAKEHOLDER DISTRIBUTION LIST

Contact Information		
Organization	Contact Name	Title
NOAA	Carl Alderson	Marine Resources Specialist
USFWS	Cathy Marion	Fish and Wildlife Biologist, NRDAR
NJDEP	David Bean	Bureau Chief, Office of Natural Resource Restoration
NJDEP	Mark Walters	Project Manager, Office of Natural Resource Restoration
NJDEP	Tony Iavarone	Project Manager, Office of Natural Resource Restoration
NJDEP	Shawn Crouse	Principal Fisheries Biologist, NJ Division of Fish & Wildlife
NJDEP	John King	Project Manager, Office of Natural Resource Restoration
NRCS	Christine Hall	State Resource Conservationist
American Rivers	Laura Craig	Associate Director, River Restoration Program
TNC	Beth Styler Barry	River Restoration Manager
Trout Unlimited	Cole Baldino	NJ Upper Delaware River Home Rivers Initiative Manager
The Watershed Institute	Jim Waltman	Executive Director
Duke Farms	Michael Catania	Executive Director
ACOE	Peter Wepppler	Chief, Environmental Analysis Branch
Rutgers University	Rick Lathrop	Director, Grant F. Walton Center for Remote Sensing & Spatial Analysis
Rutgers University	Sara Malone	Facilitator, Sustainable Raritan River Initiative
The Watershed Institute	Steve Tuorto	Director of Science & Stewardship
Duke Farms	Tom Almindinger	Director, Natural Resources and AgroEcology
NRCS	Evan Madlinger	Biologist, Frenchtown Service Center
Raritan Headwaters Association	George Schaberg	Land Projects Manager
Raritan Headwaters Association	Kristi MacDonald	Director of Science
NJ Audubon Society	Sandra Meola	Director, Coalition for the Delaware River Watershed
NFWF	Rachel Dawson	Program Director, Delaware River
NFWF	Lynn Dwyer	Program Director, Northeast - Coastal
Lower Raritan Watershed Partnership	Heather Fenyk	Executive Director
Lawrence Brook Watershed Partnership	Alan Godber	Executive Director
Raritan Headwaters Association	William Kibler	Director of Policy and Science
TNC	Barbara Brummer	State Director
Rutgers University	Michele Bakacs	County Environmental and Resource Management Agent
Rutgers University	JeanMarie Hartman	Associate Professor, School of Environmental and Biological Sciences
Rutgers University	Chris Obropta	Extension Specialist in Water Resources with Rutgers Cooperative Extension
Raritan Headwaters Association	Cindy Ehrenclou	Executive Director

New Jersey Water Supply Authority, Watershed Protection Programs	Kathy Hale	Principal Watershed Protection Specialist
New Jersey Water Supply Authority, Watershed Protection Programs	Ken Klipstein	Director
Lower Raritan Watershed Partnership	Bill Schultz	Raritan Riverkeeper
NYNJ Baykeeper	Greg Remaud	Chief Executive Officer
Central NJ Stream Team	Jens Riedel	President
Central NJ Stream Team	Andy Still	
Alexandria Township	Michelle Garay	Mayor
Bedminster Township	Steven Parker	Mayor
Berkeley Heights	Robert Woodruff	Mayor
Bernards Township	John Carpenter	Mayor
Bernards Township	Leslie Meth	Secretary, Environmental Commission
Bernardsville, Borough of	Kevin Sooy	Mayor
Bernardsville, Borough of	Robert Baker	Member, Green Team
Bethlehem Township	Paul Muir	Mayor
Bound Brook, Borough of	Robert Fazen	Mayor
Branchburg Township	James Schworn	Mayor
Bridgewater Township	Daniel Hayes	Mayor
Califon, Borough of	Charles Daniel	Mayor
Chester, Borough of	Janet Hoven	Mayor
Chester Township	Kathy Potter	Environmental Commission Secretary
Clinton, Town of	Janice Kovach	Mayor
Clinton Township	John Higgins	Mayor
Cranbury Township	Glenn Johnson	Mayor
Cranbury Township	Jean Golisano	Environmental Commission Secretary
Delaware Township	Samuel Thompson	Mayor
Dunellen, Borough of	Robert Seder	Mayor
East Amwell Township	Tim Matthews	Mayor
East Amwell Township	Gail Brewi	Environmental Secretary
East Brunswick Township	Brad Cohen	Mayor
East Windsor Township	Janice Mironov	Mayor
Edison Township	Thomas Lankey	Mayor
Fanwood, Borough of	Colleen Mahr	Mayor
Far Hills, Borough of	Paul Vallone	Mayor
Flemington, Borough of	Phil Greiner	Mayor
Franklin Township (Somerset County)	Phillip Kramer	Mayor
Franklin Township (Hunterdon County)	Craig Repmann	Mayor
Glen Gardner, Borough of	Mattias Schroeter	Mayor
Green Brook Township	Patrick Boccio	Mayor
Hampton, Borough of	James Cregar	Mayor
Helmetta, Borough of	Christopher Slavicek	Mayor

High Bridge, Borough of	Mark Desire	Mayor
High Bridge, Borough of	Lynn Hughes	Council Liason for Environmental Commission
Highland Park	Gayle Brill Mittler	Mayor
Hightstown, Borough of	Lawrence Quattrone	Mayor
Hillsborough Township	David Kois	Sustainable Hillsborough Steering Committee Contact
Hopewell, Borough of	Paul Anzano	Mayor
Hopewell Township	Kevin Kuchinski	Mayor
Jamesburg, Borough of	Marlene Lowande	Mayor
Lawrence Township	Kevin Nerwinski	Manager
Lebanon, Borough of	Michael Reino	Mayor
Lebanon Township	Adam Duckworth	Environmental and Open Space Commission Chair
Manalapan Township	Jack McNaboe	Mayor
Manville, Borough of	Richard Onderko	Mayor
Marlboro, Township of	Jonathan Hornik	Mayor
Mendham, Borough of	Neil Henry	Mayor
Mendham Township	Richard Diegnan	Mayor
Metuchen, Borough of	Jonathon Busch	Mayor
Middlesex, Borough of	Ronald Dimura	Mayor
Millstone, Borough of	Ray Heck	Mayor
Millstone Township	Gary Dorfman	Mayor
Milltown, Borough of	Eric Steebar	Mayor
Mine Hill Township	Sam Morris	Mayor
Monroe Township	Gerald Tamburro	Mayor
Montgomery Township	Christine Madrid	Mayor
Mount Arlington, Borough of	Michael Stanzilis	Mayor
Mount Olive Township	Rob Greenbaum	Mayor
Mountainside, Borough of	Paul Mirabelli	Mayor
New Brunswick, City of	James Cahill	Mayor
North Brunswick Township	Francis Womack	Mayor
Old Bridge Township	Owen Henry	Mayor
Peapack Gladstone, Borough of	William Muller	Mayor
Pennington, Borough of	Anthony Persichelli	Mayor
Perth Amboy, City of	Wilda Diaz	Mayor

Piscataway Township	Brian Wahler	Mayor
Plainfield, City of	Adrian Mapp	Mayor
Plainsboro, Township of	Peter Cantu	Mayor
Princeton, Borough of		
Princeton Township	Liz Lempert	Mayor
Randolph Township	Mark Forstenhausler	Mayor
Raritan, Borough of	Charles McMullin	Mayor
Raritan Township	Michelle Cavalchire	Chairman, Environmental Commission
Readington Township		Environmental Commission
Rocky Hill Borough	Phil Kartsonis	Mayor
Roxbury Township	Mark Crowley	Mayor
Sayreville, Borough of	Kennedy O'Brien	Mayor
Scotch Plains Township	Al Smith	Mayor
Somerville, Borough of	Ellen Brain	Mayor
South Amboy, City of	Fred Henry	Mayor
South Bound Brook, Borough of	Chris Shoffner	Mayor
South Brunswick Township	Charlie Carley	Mayor
South Plainfield Borough	Matt Anesh	Mayor
South River Borough	John Krenzel	Mayor
Spotswood Borough	Edward Seely	Mayor
Summit, City of	Nora Radest	Mayor
Tewksbury Township	Louis DiMare	Mayor
Union Township (Hunterdon County)	Matt Severino	Mayor
Warren Township	Krisann Bintley	Secretary, Environmental Commission
Robbinsville Township (Mercer County)	Dave Fried	Mayor
Washington Township (Morris County)	Bill Roehrick	Mayor
Watchung, Borough of	Stephen Pote	Mayor
West Amwell Township	Cathy Urbanski	Chair, Environmental Commission
West Windsor Township	Hemant Marathe	Mayor
Monmouth County Freeholder	Amber Mallm	Staff Advisor, Monmouth County Environmental Council
Mercer County Freeholder	Lucille Walter	Chair, Freeholders board
Middlesex County Freeholder	Ronald Rios	Freeholder Director
Morris County Freeholder	Douglas Cabana	Freeholder Director
Somerset County Freeholder	Patrick Scaglione	Freeholder Director
Union County Freeholder	Sergio Granados	Freeholder Chairman
Hunterdon County Freeholder	Matthew Holt	Freeholder Director

APPENDIX B: 114 RECEIVED RESTORATION OPPORTUNITIES

Project Title	Habitat	Activities	Watershed	County
Margaret's Creek Marsh Hydrologic Enhancement and Marsh Restoration	Marine/Estuarine Wetlands	Restoration, Debris Removal, Maintenance/Management	Raritan Bay	Middlesex County
South Amboy Wetlands Restoration	Marine/Estuarine Wetlands	Restoration, Debris Removal, Maintenance/Management		Middlesex County
Davidson's Mill Dam Fish Ladder	Riverine	Restoration		Middlesex County
Farrington Lake Fish Passage Structure	Riverine	Restoration	Lawrence Brook	Middlesex County
Mill Pond Dam Fish Passage Structure	Riverine	Restoration		Middlesex County
Blackwells Mill Dam - Millstone River	Riverine	Restoration	Raritan	Somerset County
Lamington River Dam #1 - Burnt Mills Dam	Riverine	Restoration, Protection	Raritan	Somerset County
Mill Street Dam - N. Branch Raritan River	Riverine	Restoration, Protection,	Raritan	Somerset County
Dam Removal and USGS Gage Replacement at Blackwells Mills	Riverine, Freshwater Wetlands	Restoration	Millstone above Amwell Road	Somerset County
Bridle Shiner Restoration - Millstone River Tributaries	Riverine, Upland, Freshwater Wetlands	Restoration, Protection,	Raritan	Somerset County
Princeton Shopping Center Capturing Each Drop	Upland	Restoration, Education, Maintenance/Management, Protection,	Raritan	Mercer County
Harry's Brook Riparian Restoration of the Former Princeton Flood House, 59 Meadowbrook Drive, Princeton NJ	Riverine	Education, Restoration, Protection,	Raritan River watershed	Mercer County
Brook Floater Restoration - Lamington River / Stony Brook / Raritan River	Riverine	Restoration, Protection,	Raritan	Somerset County, Hunterdon

Lamington/Black River Dam #8 - Furnace Road Dam	Riverine	Restoration	Raritan	Morris County
Lamington/Black River Dam #7 - Cooper Mill Dam		Restoration	Raritan	Morris County
Echo Hill Pond ADA- Accessible Dock	Freshwater Wetlands	Education, Protection	South and North Branch of the Raritan	Hunterdon County
Arboretum Fencing	Upland	Restoration, Protection	North and South Branch of the Raritan (WMA 08)	Hunterdon County
Lamington/Black River Dam #6 - Kays Pond Dam	Riverine	Restoration	Raritan	Morris County
Lamington/Black River Dam #5		Restoration	Raritan	Morris County
Lamington/Black River Dam #4	Riverine	Restoration	Raritan	Morris County
Lamington/Black Dam #3	Riverine	Restoration	Raritan	Morris County
Stormwater and Stream Improvements along Walnut Brook at Dvoor Farm, Raritan Township, Hunterdon County, NJ	Riverine, Freshwater Wetlands	Education, Restoration	First Neshanic	Hunterdon County
Lamington/Black Dam #2		Restoration	Raritan	Hunterdon County
Boat Ramp Dock	Marine/Estuarine Wetlands, Freshwater Wetlands	Education, Maintenance/ Management		Middlesex County
Ravine Lake Dam	Riverine	Restoration	Raritan	Somerset County
Implementation of the Raritan-Piedmont Wildlife Habitat Partnership Forest and Riparian Conservation Plan: Stage 1	Riverine, Upland, Freshwater Wetlands	Restoration, Land Acquisition, Protection		
Stony Brook Erosion and Turbidity Control Demonstration Project at The Watershed Institute Reserve	Riverine	Education, Restoration, Protection	Raritan River watershed	Mercer County

Raritan Center Degraded Wetlands	Riverine, Marine/Estuarine Wetlands, Freshwater Wetlands	Restoration,		Middlesex County
Lower Raritan Restoration Opportunities - Taken from Volume 1 - Hudson-Raritan Estuary Comprehensive Restoration Plan -	Riverine, Marine/Estuarine Wetlands, Upland	Restoration, Debris Removal, Protection,	Lower Raritan	
Weston's Mill Pond Dam Fish Ladders	Subtidal, Riverine, Marine /Estuarine Wetlands, Freshwater	Restoration, Education, Maintenance/Management, Protection,	Lawrence Brook	Middlesex County
Princeton Trails Project	Riverine, Upland, Freshwater Wetlands	Education, Maintenance/Management, Protection,	Stony Brook	Mercer County
South River Ecosystem Restoration & Flood Resiliency Enhancement Project	Marine/Estuarine Wetlands	Restoration,	Lower Raritan WMA	Middlesex County
Pond Removal on a Tributary to Rockaway Creek	Riverine, Freshwater Wetlands	Restoration,	Rockaway Creek	Hunterdon County
Burnt Mills Dam Removal	Riverine, Freshwater Wetlands	Restoration,	Lamington River	Somerset County
Native Fish Conservation	Riverine	Education, Maintenance/Management, Protection,	Raritan Watershed	Middlesex County
ADA Accessible Boardwalk at The Watershed Institute	Upland, Freshwater Wetlands	Education,	Stony Brook-Millstone/Raritan	Mercer County
Riparian Restorations	Riverine	Restoration, Maintenance/Management, Protection,		Middlesex County
Beisler Lake Dam Removal On Spruce Run Creek	Riverine, Upland, Freshwater Wetlands	Education, Restoration,	Raritan	Hunterdon County
Helmetta Pond Restoration	Riverine, Freshwater Wetlands	Restoration,		Middlesex County
Anker Park Pond Restoration	Riverine, Freshwater Wetlands	Education, Restoration, Debris Removal, Protection,		Mercer County
Acquisition of Shea Property - Edison Township	Upland	Land Acquisition,	Arthur Kill/Raritan Basin	Middlesex County

Acquisition of Ferrante Property - Edison Township	Upland	Land Acquisition,	Arthur Kill/Raritan Basin	Middlesex County
Supporting River Recreation & Recreation Opportunities Awareness in the Raritan Basin	Subtidal, Marine/Estuarine Wetlands, Upland, Freshwater Wetlands	Protection,	Raritan River Watershed, WMA 8,9,and	Somerset County
Manalapan Lake Riparian Restoration	Riverine, Freshwater Wetlands	Restoration, Protection,	Manalapan	Middlesex County
Two ADA-Accessible Pond Docks at Crystal Springs	Freshwater Wetlands	Education, Protection,	South Branch of the Raritan	Hunterdon County
Bear Brook Pathway Improvements	Riverine, Freshwater Wetlands		Raritan River / Millstone River / Bear Brook	Mercer County
Restoration of the Peter's Brook Riparian Zone	Riverine, Upland	Education, Restoration, Debris Removal, Maintenance/	Lower Raritan Watershed / Somerset	
Urban Forest Protection and Management in the Raritan River Basin	Riverine, Upland	Education, Restoration, Debris Removal, Land Acquisition, Maintenance		
South River Tidal Marsh Restoration Design	Marine/Estuarine Wetlands	Restoration,		
Supporting River Recreation & Recreation Opportunities Awareness in the Lower Raritan	Riverine, Upland	Education,	Lower Raritan Watershed	Middlesex County
Rockafellow Mill Dam Removal, River Restoration, and Open Space Preservation	Riverine, Upland, Freshwater Wetlands	Restoration, Debris Removal, Maintenance/ Management, Land	WMA 8; Raritan Headwaters	Hunterdon County
Construction of 'missing link' bridge structure over D&R Canal Spillway in New Brunswick	Riverine	Restoration, Education,	Lower Raritan Watershed	Middlesex County
Lyell's Brook Recreated: A Green Infrastructure Corridor to the Raritan River	Riverine, Upland	Education, Restoration,	Lower Raritan Watershed	
Woodbridge Forested Wetland Restoration Project	Riverine	Restoration, Land Acquisition,	Raritan River Watershed	Middlesex County
"Trash Traps" Installation for the Lower Raritan River	Riverine, Marine/Estuarine Wetlands	Education, Debris Removal,	Lower Raritan Watershed	

Olsen Property Acquisition	Upland, Freshwater Wetlands	Land Acquisition, Protection,	Raritan Headwaters	Hunterdon County
Raritan Headwaters/Bethlehem Township Watershed Project	Upland	Restoration, Maintenance/Management, Protection,	Raritan River	Hunterdon County
South River Ecosystem Restoration & Flood Resiliency Enhancement Project	Marine/Estuarine Wetlands	Restoration,	Lower Raritan WMA	Middlesex County
Living Shoreline	Riverine, Freshwater Wetlands	Restoration, Education, Protection,		Middlesex County
East Brunswick Wetlands Restoration	Riverine, Marine/Estuarine Wetlands	Restoration		Middlesex County
Anker Park Pond Restoration	Riverine, Freshwater Wetlands	Restoration, Debris Removal,	Raritan River / Millstone River / Bear Brook	Mercer County
Sayreville Wetlands Restoration	Riverine, Marine/Estuarine Wetlands,	Restoration,		Middlesex County
Edison Wetlands Restoration	Marine/Estuarine Wetlands	Restoration, Debris Removal,		Middlesex County
Edgewater Landfill Wetlands Restoration			Milltown - Raritan	Middlesex County
South River Wetlands Restoration				Middlesex County
North Branch Corridor Riparian Buffer Restoration	Riverine, Freshwater Wetlands	Restoration,		Somerset County, Hunterdon
Back Brook Tributary Restoration	Riverine	Restoration, Education,		Hunterdon County
Edison Landfill Restoration			Millstone - Raritan	Middlesex County
Removal of Impervious Surfaces & Reforestation of Lost Valley	Riverine	Restoration, Debris Removal,		Somerset County
Lower Raritan Blue Trail and Recreation Guide	Riverine, Marine/Estuarine Wetlands, Upland, Freshwater Wetlands	Education, Debris Removal, Protection,	Lower Raritan River (NJ WMA9)	Middlesex County

ADA Park Improvements	Upland	Maintenance/Management		Middlesex County
Lenape Trail Maintenance Project	Riverine	Restoration, Debris Removal, Maintenance/Management, Protection,	Millstone River	Middlesex County
Raritan River Trail Connector	Riverine, Freshwater Wetlands	Restoration, Education, Debris Removal, Protection,	Lower Raritan	Middlesex County
DPW Relocation & Riverfront Restoration	Riverine	Restoration,		Somerset County
Restoration of the Peter's Brook Riparian Zone	Riverine, Upland	Restoration, Education, Debris Removal, Maintenance/		Somerset County
Urban Forest Protection and Management in the Raritan River Basin	Riverine, Upland	Restoration, Education, Debris Removal, Maintenance/	Raritan River Basin	Somerset, Middlesex, Monmouth,
South River Tidal Marsh Restoration Design	Marine/Estuarine Wetlands	Restoration,	Lower Raritan WMA	Middlesex County
Lower Raritan Watershed Blue Trail & Recreation Guide	Riverine, Marine/Estuarine Wetlands, Upland, Freshwater Wetlands	Education,		Middlesex County
Wheelchair accessible trail in Rutgers Ecological Preserve	Riverine, Upland	Education, Maintenance/Management,	Raritan	Middlesex County
Acquisition of G&P Property - Old Stone Bridge	Riverine, Upland	Land Acquisition,	Lower Raritan/Raritan River	Somerset County
G & P Properties Acquisition	Riverine	Education, Restoration, Debris Removal, Land Acquisition,	Lower Raritan River (Lawrence to	Somerset County
Headgates Dam Removal	Riverine, Upland	Restoration, Debris Removal,	Raritan River	Somerset County
FRANKLIN TOWNSHIP LAND TRAIL	Riverine, Freshwater Wetlands	Education, Restoration, Debris Removal, Protection,	Raritan	Hunterdon
East Brunswick Swamp Pink Restoration	Freshwater Wetlands	Restoration, Maintenance/Management	Lawrence Brook	Middlesex County

South Amboy Oyster Restoration	Subtidal	Restoration,		Middlesex County
West Morris Greenway - Calais Road Trail	Upland, Freshwater Wetlands	Land Acquisition, Maintenance /Management,	Black River, India Brook	Morris
Walnut Brook Riparian restoration and stabilization	Riverine, Upland	Restoration, Education, Debris Removal, Maintenance/	Neshanic River	Hunterdon County
Taylor's Mill Dam	Riverine	Restoration, Debris Removal,	Raritan	Hunterdon County
Cherry Brook Preserve Restoration - Constructed Wetland	Freshwater Wetlands	Education, Restoration,	Beden Brook	Somerset County
County Boat Launch at Lincoln Avenue Park		Maintenance/Management,	Raritan	Somerset County
Califon Dam	Riverine	Restoration, Protection	Raritan	Hunterdon County
Kline's Mill Dam	Riverine, Freshwater Wetlands	Restoration	Raritan	Somerset County
Kingston Mill Dam	Riverine	Restoration	Raritan	Mercer County
Carnegie Lake Dam	Riverine	Restoration, Maintenance/Management	Raritan	Mercer County
Duheral Dam - Removal	Riverine, Freshwater Wetlands			
Donaldson Park Dock Piling Replacement	Riverine	Maintenance/Management	Lower Raritan/Raritan River	Middlesex County
Lake Solitude Dam - Removal	Riverine		Millstone-Raritan	Hunterdon
Island Farm Weir Rock Ramp	Riverine	Education, Restoration		Somerset County

Raritan watershed restoration through dam removals	Riverine, Upland, Freshwater Wetlands	Restoration, Education,		Somerset County
Woodbridge Township Floodplain Restoration Project	Riverine, Marine/Estuarine Wetlands, Upland, Freshwater wetlands	Restoration, Education, Maintenance/Management, Land	Raritan	Middlesex County
Headgates Dam Removal	Riverine, Upland	Restoration, Debris Removal		Somerset County
Dam removal - Headgates at Duke Island	Riverine, Freshwater Wetlands	Restoration, Debris Removal, Protection		
Weston Pond Weir and Horseshoe Dam Fish Ladder	Riverine	Restoration	Lawrence Brook sub watershed of	Middlesex County
Proposed Cottrell Farm Park	Upland	Restoration		Middlesex County
Lawrence Hopewell Trail - Pretty Brook Road			Stony Brook	Mercer County
Dam removal		Restoration		
High Bridge Dam, High Bridge NJ				
Clinton Mill Dam	Riverine	Restoration, Education,	South Branch - Upper Raritan Watershed	Hunterdon County
Hamden Pump Station Dam	Riverine	Restoration,	Raritan	Hunterdon County
Rockafellow Mills Dam Removal	Riverine	Restoration, Protection	Raritan	Hunterdon County
Head Gates Dam removal	Riverine	Restoration	Raritan-Millstone	Somerset
Island Farm Weir Fish Ladder Improvements	Riverine	Restoration	Raritan	Somerset County

APPENDIX B: PROJECT LIST REDUCED TO 70 RESTORATION OPPORTUNITIES

TYPE_ID	SITE_NAME	DOMINANT FEATURE	TRIBUTARY	WATERSHED	COUNTY	MUNICIPALITY
FISHPASS	Island Farm Weir	Man-made Dam	Millstone River	Lower Raritan	Somerset	Bridgewater Township, Franklin Township (Somerset)
DAMREMOV	Headgates Dam Removal	Man-made Dam	Raritan Mainstem	Lower Raritan	Somerset	Hillsborough
DAMREMOV	Rockafellow Mills Dam Removal	Man-made Dam	South Branch Raritan River	Upper Raritan	Hunterdon	Raritan Township and Readington Township
DAMREMOV	Hamden Pump Station Dam Removal/Alteration	Man-made Dam	South Branch Raritan River	Upper Raritan	Hunterdon	Clinton Township
FISHPASS	Clinton Mill Dam Fish Passage Alternatives	Man-made Dam	South Branch Raritan River	Upper Raritan	Hunterdon	Clinton Township
DAMREMOV	High Bridge Dam Removal					
RECREAT	Lawrence Hopewell Trail - Pretty Brook Road Segment	Trail	Stony Brook	Millstone	Mercer	Lawrence Twp
FISHPASS	Weston's Arch Dam and Weston's Mill Pond Dam Fish Ladders	Man-made Dam	Lawrence Brook	Lower Raritan	Middlesex	New Brunswick
DAMREMOV	Lake Solitude Dam Removal	Man made Dam	South Branch Raritan River	Upper Raritan	Hunterdon	High Bridge Borough
DAMREMOV	Duhernal Dam Removal	Man-made Dam	South River	Lower Raritan	Middlesex	East Brunswick
FISHPASS	Carnegie Lake Dam	Man-made Dam	Millstone River	Millstone	Mercer	Princeton Twp
FISHPASS	Kingston Mill Dam	Man-made Dam	Millstone River	Millstone	Mercer	Princeton Twp
DAMREMOV	Kline's Mill Dam Removal	Man-made Dam	North Branch Raritan River	Upper Raritan	Somerset	Bedminster Township
DAMREMOV	Califon Dam Removal	Man-made Dam	South Branch Raritan River	Upper Raritan	Hunterdon	Califon Borough
RECREAT	County Boat Launch at Lincoln Avenue Park	Boat Launch	Millstone River	Millstone	Somerset	Manville
WETLAND	Cherry Brook Preserve Restoration - Constructed Wetland	Pond	Cherry Brook and Bedens Brook	Millstone	Somerset	Montgomery
DAMREMOV	Taylor's Mill Dam Removal	Man-made Dam	Rockaway Creek	Upper Raritan	Hunterdon	Readington Twp

TYPE_ID	SITE_NAME	DOMINANT FEATURE	TRIBUTARY	WATERSHED	COUNTY	MUNICIPALITY
RIPARIAN	Walnut Brook Stream Restoration	Riparian	Walnut Brook	Upper Raritan	Hunterdon	Raritan Twp
SHELLFISH	Raritan Bay Oyster Restoration	Shoreline	Raritan Mainstem	Lower Raritan	Middlesex	South Amboy
INVASCSP	East Brunswick Swamp Pink Restoration	Forested wetland		Lower Raritan	Middlesex	East Brunswick
RECREAT	Franklin Township Land Trail	Trail	NA	Upper Raritan	Hunterdon	Franklin Twp (Hunterdon)
RECREAT	Wheelchair Accessible Trail in Rutgers Ecological Preserve	Trail	Buell Brook	Lower Raritan	Middlesex	New Brunswick
WETLAND	South River Tidal Marsh Restoration	Tidal Wetland	South River	Lower Raritan	Middlesex	Edison Township
RIPARIAN	Restoration of the Peter's Brook Riparian Zone	Riparian	Peters Brook	Lower Raritan	Somerset	Somerville Borough, Bridgewater Township
WATRQUAL	Raritan Headwaters/Bethlehem Township Watershed Project	Retention/Detention Basins	NA	Upper Raritan	Hunterdon	Bethlehem Twp
RECREAT	Raritan River Trail Connector	Trail	Raritan Mainstem	Lower Raritan	Middlesex	Highland Park
RECREAT	Lenape Trail Maintenance Project	Trail	Cranbury Brook	Millstone	Middlesex	Plainsboro
FLDPLN	Removal of Impervious Surfaces and Reforestation of Lost	Floodplain	Millstone River	Millstone	Somerset	Manville
WETLAND	Edison Landfill Restoration	Landfill	Raritan River Mainstem	Lower Raritan	Middlesex	Edison
RIPARIAN	Back Brook Tributary Restoration	Riparian	Back Brook	Upper Raritan	Hunterdon	East Amwell Twp
RIPARIAN	North Branch Corridor Riparian Buffer Restoration	Riparian	North Branch Raritan River	Upper Raritan	Somerset, Hunterdon, Morris	Multiple
INVASCSP	Edgewater Landfill Wetlands Restoration	Invasive species	Raritan River Mainstem	Lower Raritan	Middlesex	Sayreville
INVASCSP	Sayreville Wetlands Restoration	Invasive species	Raritan River Mainstem	Lower Raritan	Middlesex	Sayreville

TYPE_ID	SITE_NAME	DOMINANT FEATURE	TRIBUTARY	WATERSHED	COUNTY	MUNICIPALITY
Other: pond	Anker Park Pond Restoration	Pond	Bear Brook	Millstone	Mercer	East Windsor
INVASCSP	East Brunswick Wetlands Restoration	Invasive species	Raritan River Mainstem	Lower Raritan	Middlesex	East Brunswick
SHELLFISH	Perth Amboy Living Shoreline	Shoreline	Raritan River Mainstem	Lower Raritan	Middlesex	Perth Amboy
LANDACQU	Olsen Property Acquisition	Upland Forest, Wetlands	Mulockaway Creek	Upper Raritan	Hunterdon	Bethlehem Twp
INSTREAM	Trash Trap Installation on the Lower Raritan River	Instream trash and debris	Green Brook, Mile Run Brook, Mill Brook and South	Lower Raritan	Middle	TBD
RECREAT	Bridge over D&R Canal Spillway	Trail	Raritan River Mainstem	Lower Raritan	Middlesex	New Brunswick
RECREAT	Bear Brook Pathway Improvements	Trail	Bear Brook	Millstone	Mercer	East Windsor
RECREAT	Two ADA-Accessible Pond Docks at Crystal Springs	Pond	Spruce Run	Upper Raritan	Hunterdon	Washington Twp (Morris)
RIPARIAN	Manalapan Lake Riparian Restoration	Riparian	Manalapan Brook	Lower Raritan	Middlesex	Monroe
LANDACQU	Acquisition of Ferrant Property	Upland Forest	NA	Upper Raritan	Middlesex	Edison
LANDACQU	Acquisition of Shea Property	Upland Forest	NA	Upper Raritan	Middlesex	Edison
DAMREMOV	Beisler Lake Dam Removal on Spruce Run Creek	Man-made Dam	Spruce Run Creek	Upper Raritan	Hunterdon	Lebanon Township
RECREAT	ADA Accessible Boardwalk at The Watershed Institute	Trail	Stony Brook	Millstone	Mercer	Hopewell Twp
	Native Fish Conservation at Perth Amboy	Shoreline	NA	Lower Raritan	Middlesex	Perth Amboy
DAMREMOV	Burnt Mills Dam Removal	Man-made Dam	Lamington River	Upper Raritan	Somerset	Bedminster Township
Other: Pond Removal	Pond Removal on Tributary to Rockaway Creek	Pond	Rockaway Creek	Upper Raritan	Hunterdon	Readington Township
WETLAND	Magarets Creek Marsh Hydrologic Enhancement	Wetlands	NA	NA	Middlesex	Old Bridge Twp

	and Marsh Restoration					
TYPE_ID	SITE_NAME	DOMINANT FEATURE	TRIBUTARY	WATERSHED	COUNTY	MUNICIPALITY
WETLAND	South Amboy Wetlands Restoration	Wetlands	NA	NA	Middlesex	Sayreville
FISHPASS	Davidson's Mill Dam fish Ladder	Man-made Dam	Lawrence Brook	Lower Raritan	Middlesex	North Brunswick
FISHPASS	Farrington Lake Fish Passage Structure	Man-made Dam	Lawrence Brook	Lower Raritan	Middlesex	East Brunswick
FISHPASS	Mill Pond Dan Fish Passage Structure	Man-made Dam	Lawrence Brook	Lower Raritan	Middlesex	Milltown
DAMREMOV	Mill Street Dam Removal	Man-made Dam	North Branch Raritan River	Upper Raritan	Somerset	Branchburg Township, Bridgewater Township
DAMREMOV	Blackwells Mill Dam Removal	Man-made Dam	Millstone River	Millstone	Somerset	Hillsborough Township, Franklin Township
Other: Restore Threatened Species	Bridle Shiner Restoration - Millstone River Tributaries	Threatened Species	Multiple	Millstone	Somerset	Multiple
Other: Restore Threatened Species	Brook Floater Restoration - Lamington River, Stony Brook, Raritan River	Threatened Species	Multiple	Multiple	Somerset ,Hunterdon ,Mercer	Multiple
DAMREMOV	Furnace Road Dam (Lamington/Black River Dam #8)	Man-made Dam	Lamington River	Upper Raritan	Morris	Chester Township
FISHPASS	Cooper Mill Dam (Lamington/Black River Dam #7)	Man-made Dam	Lamington River	Upper Raritan	Morris	Chester Twp
RECREAT	ADA Accessible Dock at Echo Hill Pond	Pond	Prescott Brook	Upper Raritan	Hunterdon	Clinton Township
DAMREMOV	Kays Pond Dam (Lamington/Black River Dam #6)	Man-made Dam	Lamington River	Upper Raritan	Morris	Chester Twp
DAMREMOV	Lamington/Black River Dam #5	Man-made Dam	Lamington River	Upper Raritan	Morris	Chester Twp
DAMREMOV	Lamington/Black River Dam #4	Man-made Dam	Lamington River	Upper Raritan	Morris	Chester Township

DAMREMOV	Lamington/Black River Dam #3	Man-made Dam	Lamington River	Upper Raritan	Morris	Washington Twp (Morris)
TYPE_ID	SITE_NAME	DOMINANT FEATURE	TRIBUTARY	WATERSHED	COUNTY	MUNICIPALITY
INSTREAM	Stormwater and Stream Improvements along Walnut Brook at Dvoor	Riparian	Walnut Brook	Upper Raritan	Hunterdon	Raritan Twp
DAMREMOV	Lamington/Black River Dam #2	Riparian	Lamington River	Upper Raritan	Hunterdon	Bedminster Twp, Tewksbury Twp
RECREAT	Boat Ramp Dock at Boyd Park	Boat Launch	Raritan Mainstem	Lower Raritan	Middlesex	New Brunswick
EDUCAT	Stony Brook Green Infrastructure Demonstration Project at	Developed Land	Stony Brook	Millstone	Mercer	Hopewell Township
WETLAND	Raritan Center Degraded Wetlands	Wetlands	Raritan River Mainstem	Lower Raritan	Middlesex	Edison

This Report, the stakeholder survey and all additional information gathering was conducted under a contract held by the NOAA, National Marine Fisheries Service Restoration Center, Office of Habitat Conservation in Highlands NJ. If you have any questions related to this report or the process that was undertaken to achieve its completion, please contact NOAA's Technical Representative Carl Alderson at carl.alderon@noaa.gov.

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